UTILITY APPS TOOLKIT

EXPERT PICKS: OUR MUST-HAVE APPS FOR PC, SMARTPHONE & TABLET

a+c

Mar 2016
Issue 426

YOUR GUI... ...AY'S TECH

RESTORE, REFRESH OR REINSTALL WINDOWS 10

FAST FIXES FOR TECH TROUBLES

THE ULTIMATE TROUBLESHOOTING GUIDE: 20+ PAGES OF ESSENTIAL KNOW-HOW FOR PC, MAC, ANDROID & iOS

TROUBLESHOOT ANYTHING!

SOLVE PROBLEMS WITH ANY DEVICE
COMPLETELY CLEAN A MALWARE-INFECTED SYSTEM
SPEED UP A SLOW PC, SMARTPHONE OR TABLET

PLUS!

COMPACT PC PARTS ON TEST

MINI-ITX & MICRO-ATX MOTHERBOARDS BENCHMARKED & REVIEWED

GET ESSENTIAL TECH SKILLS

- Install Android 6.0 on your PC or laptop
- Build a home-brewed 'Steam Machine' PC
- 12 Raspberry Pi alternatives
- Make your own Mac Fusion drive

INTRIGUING NEW PCs & TECH GEAR

- ASUS Chromebit: a $150 stick PC running Google's ChromeOS
- iPad to MacBook: keyboard cases to transform your tablet
- Remix mini: tiny Pi-powered desktop PC alternative
- Best new apps on all platforms

PINT-SIZED PC CASES

Pulled apart & thoroughly compared

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Future

IEEE 802.11ac (AC 1600) Wireless and VoIP Solution for NBN / non-NBN Home and Business Networking

DrayTek Aust & NZ
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NBN Ready | UFB Ready | 32x VPN

Vigor2860ac / Vigor2860Vac (AC 1600)

VDSL2/ADSL2+ & Gigabit-WAN VPN Firewall Router

- Multi-WAN with VDSL2/ADSL2+, Gigabit Ethernet WAN and USB ports for 3G/4G dongles
- Six Gigabit LAN ports with multiple subnets and 50,000 NAT sessions
- Two USB ports for 3G/4G USB modems, network printer, storage and USB thermometer
- Integrated IEEE 802.11ac wireless Access Point; dual band; up to 1600Mbps throughput
- VoIP (2 x FXS and 1 x FXO Line Port) for Vigor2860Vac

NBN Ready | UFB Ready | 50x VPN

Vigor2925ac / Vigor2925Vac (AC 1600)

Dual Gigabit-WAN Broadband VPN Firewall Router

- Multi-WAN with dual Gigabit Ethernet WAN and USB ports for 3G/4G dongles
- Five Gigabit LAN ports with multiple subnets and 50,000 NAT sessions
- Two USB ports for 3G/4G USB modems, network printer, storage and USB thermometer
- Integrated IEEE 802.11ac wireless Access Point; dual band; up to 1600Mbps throughput
- VoIP (2 x FXS and 1 x FXO Line Port) for Vigor2925Vac

NBN Ready | UFB Ready | 2x VPN

Vigor2132ac (AC 1600)

Gigabit-WAN Broadband VPN Firewall Router

- 1 x Gigabit Ethernet WAN interface with security object-oriented SPI firewall and QoS
- 4 x Gigabit Ethernet LAN ports with 30,000 NAT sessions
- 2 x USB ports for USB printer, storage and USB thermometer
- Integrated IEEE 802.11ac wireless Access Point; dual band; up to 1600Mbps throughput

TAIWAN EXCELLENCE 2015

VigorAP 910C (AC 1200)

802.11ac Ceiling Mount Wireless Access Point

- IEEE 802.11ac wireless Access Point with PoE PD port and ceiling mount housing
- Supports multiple SSID with bandwidth management per SSID
- Equipped with advanced central wireless management (AP Management)
- Up to 1200Mbps Wi-Fi throughput

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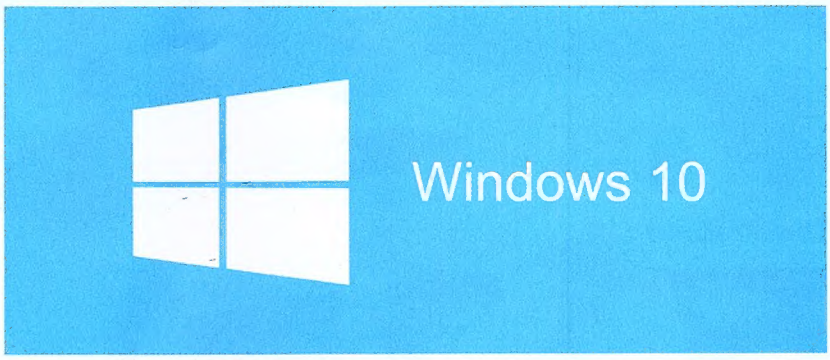
FIPP



Clock's ticking on Windows 10 upgrade

APC's editor asks: 'If you haven't yet upgraded, should you?'

We've covered it numerous times before in *APC*, but it's worth reiterating. During the first year of its availability, Microsoft has made Windows 10 available as a free upgrade to owners of Windows 7 and 8.1. There's no real caveat to this – the upgrade is legitimately free and Microsoft won't ever try to charge you for it, either now or in the future. (Well, unless you upgrade from a pirated copy of Windows, in which case, you'll have to pony up.)

The software giant clearly wants everyone to upgrade and it has become even more aggressive about it in recent months, even pre-downloading the installation files to Windows 7 and 8.1 users who haven't requested the upgrade.

Microsoft has repeatedly said that it wants Windows 10 on one billion devices by mid-2018, but the company's reasons for wanting more users on its latest OS aren't entirely altruistic. It doesn't just want you to upgrade because Windows 10 is a better OS than Windows 8 (which it definitely is). The Redmond company's changing business model, where it's shifting to selling services versus its traditional software, means it needs to get its products in front of as many eyes as possible.

That's proven to be a bit of a tough sell in a world where the smartphone has become the computing device of choice for most people, but where Microsoft's own smartphone platform has shrunk to around 5% of the total market.

Windows 10 is one big part of the answer: it has Microsoft's cloud services (like OneDrive) and the Windows Store both deeply integrated, so there's more reasons for people to start using them and start buying Microsoft products.

So what happens if you don't upgrade to Windows 10 by the end of July? Well, given that Microsoft has only reached the 200 million mark in that 'billion devices' goal (as of February 2016), our best guess is that the upgrade offer will be extended – perhaps until the end of 2016, perhaps another entire year. But it may instead start charging users for the privilege – though we'd hazard that could just be a small fee, say US$20 to US$50.

If you haven't yet upgraded, then, we'd suggest you can safely hold off until the start of July. If, at that time, Microsoft still hasn't announced an extension to the upgrade period, it's probably time to make that final decision about whether to bite the bullet and upgrade, or stick with what you're currently on. ■

DAN GARDINER
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Issue 42 [illegible] 2016

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COMPACT PC PARTS ON TEST

APC ROUNDS UP THE BEST MOTHERBOARDS AND CASES FOR CONSTRUCTING YOUR OWN PINT-SIZED PC.

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"Hard disks are like dogs; once they bite you, you can't truly trust them again." Q&A Quick Tips, page 76.

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News from the world of geekdom.

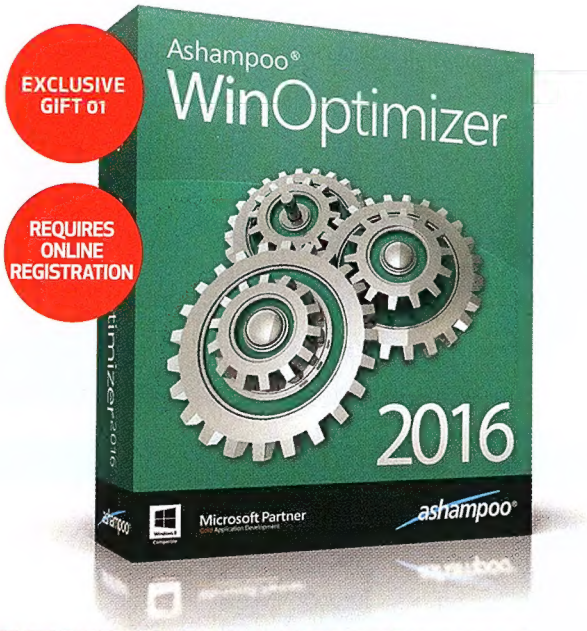
TURN THE PAGE FOR YOUR EXCLUSIVE FREE SOFTWARE OFFERS

exclusive software

» HOW TO DOWNLOAD YOUR FREE FULL-VERSION PROGRAMS

ISSUE 426, MARCH 2016

Please note that these exclusive downloads will only be available for a limited time, from 03/03/2016 to 21/04/2016.



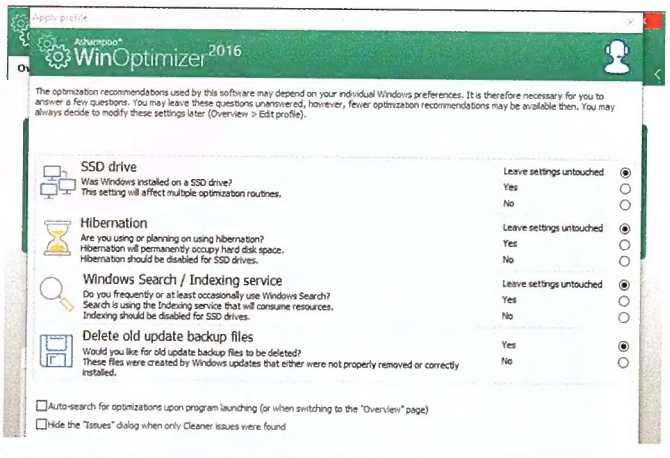
GIVE WINDOWS A NEW OUTLOOK ON LIFE

Dust off the cobwebs with Ashampoo WinOptimizer 2016.

FULL VERSION REQUIRES ONLINE REGISTRATION.

Ashampoo WinOptimizer 2016 is a powerful system optimisation tool that frees space, fixes errors and maintains your PC's performance. It also protects your privacy and allows you to customise your Windows environment. Aside from hard disk cleaners, the program comes with multiple tools that cover various tasks from system maintenance, tweaking and system analysis to file processing (encryption, splitting, etc).

DOWNLOAD LINK: www.ashampoo.com/lpa/apcmagazine


Ashampoo® WinOptimizer 2016
The optimization recommendations used by this software may depend on your individual Windows preferences. It is therefore necessary for you to answer a few questions. You may leave these questions unanswered, however, fewer optimization recommendations may be available then. You may always decide to modify these settings later (Overview > Edit profile).
SSD drive
Was Windows installed on a SSD drive?
This setting will affect multiple optimization routines.
Hibernation
Are you using or planning on using hibernation?
Hibernation will permanently occupy hard disk space.
Hibernation should be disabled for SSD drives.
Windows Search / Indexing service
Do you frequently or at least occasionally use Windows Search?
Search is using the Indexing service that will consume resources.
Indexing should be disabled for SSD drives.
Delete old update backup files
Would you like for old update backup files to be deleted?
These files were created by Windows updates that either were not properly removed or correctly installed.
Leave settings untouched
Yes
No
Auto-search for optimizations upon program launching (or when switching to the "Overview" page)
Hide the "Issues" dialog when only Cleaner issues were found

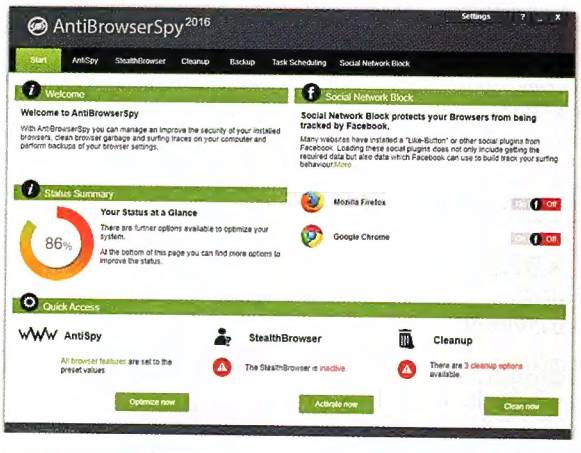
REGAIN PRIVACY ON THE INTERNET

Abolish spyware with Abelssoft AntiBrowserSpy 2016.

FULL VERSION WORTH US$48.

Many espionage features of common web browsers cannot be disabled by PC users — even experts cannot turn them all off. AntiBrowserSpy makes it very easy to control all browser settings: with one mouse click, you can configure the settings of all your browsers and disable even hidden espionage features. The stealth feature radomises your UserAgent, so your browser fingerprint cannot be tracked back to you. Meanwhile, AntiBrowserSpy allows you to remove internet traces easily, including history entries and web cache.

DOWNLOAD LINK: www.apcmag.com/exclusives
DOWNLOAD ZIP PASSWORD: March16a


AntiBrowserSpy 2016
Settings
Start
AntiSpy
StealthBrowser
Cleanup
Backup
Task Scheduling
Social Network Block
Welcome
Welcome to AntiBrowserSpy
With AntiBrowserSpy you can manage an improve the security of your installed browsers, clean browser garbage and surfing traces on your computer and perform backups of your browser settings.
Social Network Block
Social Network Block protects your Browsers from being tracked by Facebook.
Status Summary
Your Status at a Glance
86%
There are further options available to optimize your system.
At the bottom of this page you can find more options to improve the status.
Mozilla Firefox
Google Chrome
Off
Quick Access
AntiSpy
All browser features are set to the preset values
Optimize now
StealthBrowser
The StealthBrowser is inactive.
Activate now
Cleanup
There are 3 cleanup options available.
Clean now

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Inside APC

Find out all about *APC*'s editorial policies, test practices, how to read the benchmark results and more.

APC is Australia's oldest consumer technology magazine – having been consistently in print for over 35 years, since our first issue way back in May 1980 – and we take that heritage and responsibility very seriously. While our focus is obviously on the personal computer – it's in our name, after all – the very definition of the PC has changed and shifted markedly since the early 1980s. As such, we touch on many other areas of tech too, from smartphones and apps to peripherals, accessories, online services and beyond. We have two main goals: to track down the best of modern tech and also to help our readers make the most of it.

We're also an open church in terms of platforms. We know most people aren't wed to a single brand's products and use a variety of devices. And like you, *APC*'s journalists want to know what's good in tech – no matter what platform it resides on.

INDEPENDENT REVIEWS

Championing technology doesn't mean we're unrelenting yes-men, however, and *APC* aims to be as objective as possible in all our coverage. That means identifying the best products from multiple perspectives – the best performance, best value and best features and, ideally, the products that offer the best mix of these three.

As a matter of policy, reviews published in *APC* are not shared with product-makers prior to print. We will contact vendors under certain conditions; for example, if we have a problem testing a product that seems to indicate it may be faulty, or to invite a vendor to clarify how a particular feature works. If an *APC* reviewer has any potential conflicts of interest involving a brand, the review will always be assigned to another writer.

LABS TESTING

Despite being a small magazine with limited resources, *APC* still still strives to conduct the most rigorous, objective scientific tests and benchmarks we can so as to make our reviews as unbiased as possible. We use a variety of tools and programs for this, including many freely available benchmark suites for assessing media encoding, general system performance, gaming and battery life.

In most cases, for the benchmark results published in *APC*, you can assume that higher is better. There are certain tests that deviate from this rule and where the opposite is true; in those cases, we've flagged the results with a note explaining as such.

We use both tables and graphs for displaying results; the latter are our preference due to their ease-of-readability, but tables are more compact, so we use these in cases where thoroughness is preferred.

technotes

» NEED TO KNOW

Metadata madness

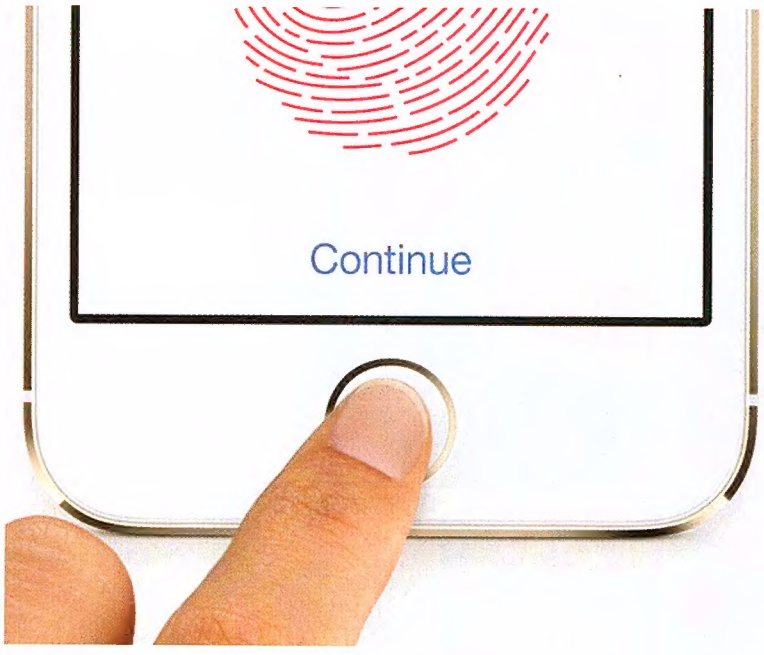
61 agencies, including lamb-chop weight enforcers, want warrantless access to your Internet and phone records.

Since the introduction of the government's mandatory data retention laws in October last year, a reported 61 agencies have submitted requests to Attorney General George Brandis in an attempt to gain warrantless access to your metadata. Though a recent review of the legislation provided some restriction to the types of agencies that would be granted access to the data, there is potential for that list to be expanded — Brandis could decide to introduce a regulation that would allow these applicants to be declared legitimate 'criminal law enforcement agencies'. Perhaps the most startling aspect of this report is the sheer number of agencies that have applied which have no business going anywhere near your private metadata. *The Guardian* has published a list of applicants, which includes agencies such as Greyhound Racing Victoria, the Department of Fisheries and, our personal favourite, the National Measurement Institute, which wants access to your data so that it can track down supermarkets that are skimping on lamb-chop portion sizes. **SL**

Under the sea!

Microsoft building new data centres in the ocean

For IT departments running and maintaining data centres, keeping them cool is usually half the battle. Determined to do away with air-conditioning costs, Microsoft is harnessing the cooling power of water, having built an experimental vessel called the Leona Philpot in order to send a data centre to the ocean floor. A successful trial of the vessel was held between August and November last year. **SL**



Apple disabling iPhones with third-party repairs

US law firms proposing class-action lawsuit.

For iPhone owners outside of their warranties, a trip to the Genius Bar can prove costly. Many people choose to take their devices to more affordable third-party repair shops; however, those who do so may be faced with a bricked device thanks to a new security feature in iOS 9. The feature causes iPhones to be bricked without warning if an unauthorised repair on the Touch ID sensor is detected after updating iOS, with only a mysterious 'Error 53' message left in its wake. Apple has stated that the security feature is intended to keep your personal information secure, as changing a device's fingerprint sensor could potentially give unauthorised users access to your private data in the iPhone's Secure Enclave. This will not happen if you get your Touch ID sensor replaced by an Apple technician. "When an iPhone is serviced by an authorised Apple service provider or Apple retail store for changes that affect the Touch ID sensor, the pairing is re-validated," said a representative for Apple.
Stephen Lambrechts

Netflix cracking down on VPN users

Video-streaming giant claims to be getting tough, but will it last?

Netflix users have so far enjoyed a fairly lenient attitude from the streaming giant in regards to region policing, with savvy users able to freely access Netflix's international catalogues thanks to VPN and proxy services. Unfortunately, that party might be coming to an end, with Netflix announcing plans to crack down on users accessing regions outside of their own. In a blog post titled 'Evolving Proxy Detection as a Global Service', Netflix Vice President of content delivery architecture David Fullagar stated that "in the coming weeks, those using proxies and unblockers will only be able to access the service in the country where they currently are". But while the service may talk a big game, does it really have the ability to block all VPN services from providing access to different territories? Tech analysts say it's unlikely, with many believing that the announcement is just an attempt to placate rights holders while Netflix figures out a way to get everyone the same content.
Stephen Lambrechts

Android beats iOS for number of apps downloaded in 2015...

But Apple's platform is still significantly more profitable.

According to App Annie's annual report on app downloads and revenue, Android users have downloaded twice as many apps as iOS users in 2015. Despite Android's upward trajectory, due largely to the growth seen in emerging markets such as India, Indonesia, Mexico, Turkey and Vietnam, iOS has still proven to be the more profitable platform, with revenue surging in the United States, China and Japan. **SL**

Brain-training games get more scrutiny in US

Federal Trade Commission is looking into the purported benefits of these games.

Think brain-training games are making you smarter? Think again (just don't strain yourself) — the Federal Trade Commission is investigating the legitimacy of 'brain games' and their claims that they can actually make you smarter. This comes after a recent $2 million settlement over *Lumosity* developer Lumos Labs', who claimed that its game could even help players prevent the onset of Alzheimer's and dementia. **SL**

Samsung sued over lack of phone updates

Firmware updates seem to be passing the Dutch by.

A Dutch watchdog group is not happy with the frequency of Samsung's smartphone firmware updates, having announced a class action lawsuit against the manufacturer. The Dutch Consumers' Association says the company has failed to provide a single Android update to 82% of the phones it's sold in The Netherlands. The group wants Samsung to be more forthright about the update expectancy of its devices **SL**

Virtually feeling it

'Ultrahaptics' ultrasonic feedback could soon let us 'feel' things in VR.

Virtual Reality has improved immeasurably over the last few years, but if there's one thing about it that breaks the illusion, it's that you can't feel objects inside your VR world. Thankfully, a solution is on the way — Tom Carter's company, Ultrahaptics, has found a way to simulate a range of feelings across your fingertips by using ultrasound emitters and programmed algorithms. **SL**

Are your light bulbs secure?

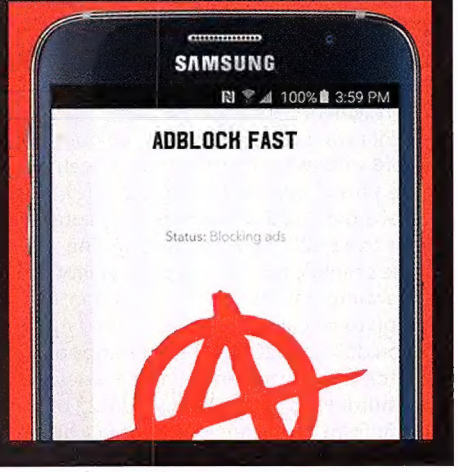
Smart-home devices could be the new backdoor for law-enforcement surveillance.

According to a study on 'going dark' published by the Berkman Center for Internet and Society at Harvard, the rise in popularity of Internet-connected smart home devices and the Internet of Things (IoT) could see law enforcement officials use these avenues to surveil suspected criminals and terrorists. The report alleges that the US intelligence and law enforcement communities are exaggerating the impact of encryption on crime prevention in part to gain more access to "alternative vectors for information-gathering that could more than fill many of the gaps left behind by sources that have gone dark." These include "appliances and products ranging from televisions and toasters to bed sheets, light bulbs, cameras, toothbrushes, door locks, cars, watches and other wearables." The study believes that "audio and video sensors on IoT devices will open up numerous avenues for government actors to demand access to real-time and recorded communications" and that "the future will be even more laden with sensors that can be commandeered for law enforcement surveillance." **Stephen Lambrechts**

Samsung gets into Android ad blocking

But Korean tech giant's app gets pulled almost immediately by Google.

Apps are removed from the Google Play Store every day, but it's not often that those rejected apps are ones used in Samsung's advertising. Adblock Fast, created by developer Rocketship Apps, was removed from the Play Store for violating a policy which prevents one app from interfering with another's functionality — in this case, a web browser's ability to serve users ads.



360°

YOUTUBE MAY SOON START OFFERING STREAMING VR VIDEOS THAT'LL LET YOU LOOK IN ANY DIRECTION.

A number of undisclosed sources familiar with YouTube have revealed that the company has been in talks with 360° video-camera makers as it looks to develop support for live 'spherical' VR video streams, according to BuzzFeed. In January, Google hired Scott Broock in a newly minted role as Global VR Evangelist. Broock formerly worked at Jaunt, a VR startup, where he signed deals with music, movie and TV producers to provide VR content. Though Google has declined to clarify Broock's role, it is suspected he's heading up content acquisition in the newly created VR division.

US $1,000,000,000

HOW MUCH GOOGLE PAID APPLE IN 2014 TO REMAIN iOS's DEFAULT SEARCH ENGINE.

Database-software giant Oracle has been in court with google since 2010 over Java code that was supposedly stolen to build the Android smartphone platform. In a hearing on the 14th of January this year, Oracle's legal council announced some previously concealed figures to a public courtroom regarding Google's mobile advertising profitability and just how integral iOS is in that equation. In addition to revealing that Google paid Apple a billion dollars in 2014 to have its apps on iOS, the attorney representing Oracle also let slip that Android has netted Google US$22 billion in profit from a total revenue of US$31 billion since it launched.

<1%

THE PROPORTION OF PCs CAPABLE OF RUNNING VR HEADSETS.

According to graphics-giant Nvidia, of the 1.43 billion PCs that are currently in use around the globe, only 13 million actually meet the hardware requirements to use VR headsets like the upcoming Oculus Rift or the HTC Vive. Given how much graphics processing is involved in rendering two separate video streams (one to each eye) at the required 90 frames per second, the lack of people with sufficient hardware probably isn't all that surprising...

16%

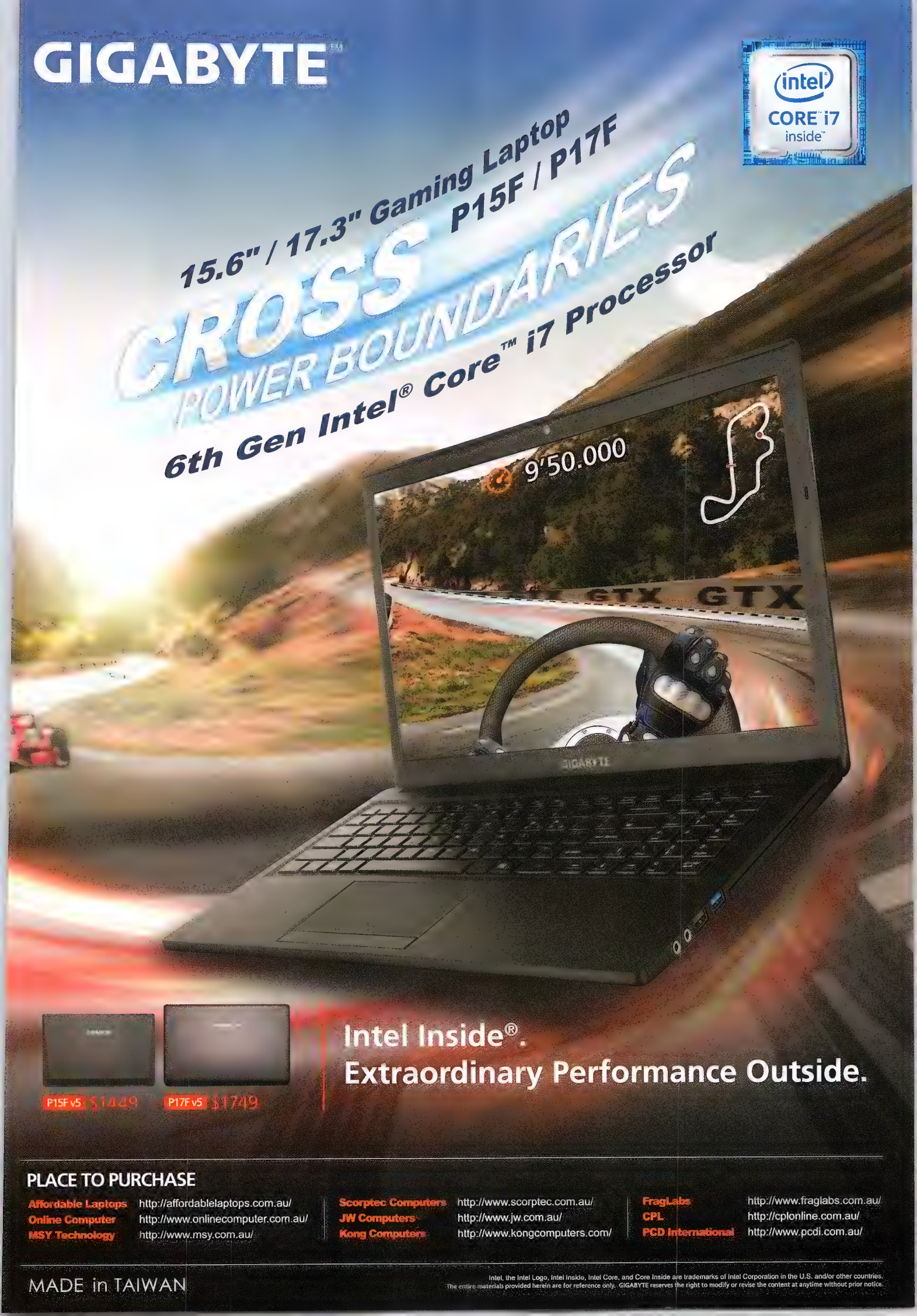
THE PERCENTAGE OF GAME DEVELOPERS MAKING TITLES FOR VR.

A survey of 2,000 game developers, taken ahead of the San Francisco Game Developers Conference that kicks off in early March, has found that close to one in five were working on something for VR. This is more than double the reported 7% of developers working on VR games back in early 2015. Of those surveyed, 19% are designing titles specifically for the Oculus Rift, 8% for Samsung Gear VR, 7% for Google Cardboard and Playstation VR and HTC's Vive scored 6%.

US$ 200,000

WHAT THE PRIVACY-FOCUSED TOR PROJECT RAISED IN ITS FIRST ATTEMPT AT CROWDFUNDING.

According to a blog post by the Onion Router (AKA Tor) project, in 2014, around 75% of the organisation's annual US$2.5 million revenue stream came from government subsidies — a substantial decrease from the estimated 90% of the year before. But in a push to further diversify its funding sources, the privacy-focused browser maker kicked off a crowdfunding campaign in November that has since netted it over US$200,000. It's a noteworthy first step that the project hopes will give it the freedom and power to act independently of its main funding sources.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technotes

» GEAR WE WANT

MARLEY LEGEND ANC

$349.95 | THEHOUSEOFMARLEY.COM.AU

The new Legend ANC cans from Marley give off a slightly more prestigious vibe than we're used to from the Rasta-styled brand. And for the most part, the company has done a good job weaving together the solid metal arms, soft leather cushioning and dark timber inlay to create a premium feel. But these active noise-cancelling headphones aren't the best noise eliminators we've heard – in fact, they'll only really cut out background-frequency hum, like engine noises or aircon – and the audio-connection cable is a bit too flakey to really hold the Legend ANCs back. The audio quality itself isn't bad, but at this premium price-point, we expected a little more.

SPECK POCKET VR

US$69.95 | SPECKPRODUCTS.COM

If you'd been holding out for the consumer edition of the Oculus Rift, but (like most of us) found yourself dissuaded when the final AU$1,100 price was announced, then you might've already considered turning to a mobile VR headsets (like Google Cardboard or Samsung's Gear VR) to tide you over until the Oculus price drops. If so, you'll be interested to know the iPhone case-maker Speck is adding its own smartphone-driven VR headset to the mix. The Pocket VR will slot in between Google's entry-level device and Samsung's $159 setup. Considering it'll fit both recent iPhones and Samsung devices, it might not be a bad alternative to get you started with VR.

DREAM SCREEN

US$125 | DREAMSCREENTV.COM

One thing known to reduce eye strain and dramatically increase the depth of colour on your TV is 'bias lighting', or simply throwing some background light on the wall behind your TV. And though there are currently a handful of TVs that come with built-in 'bias lighting' and you can always go down the DIY path, neither are ideal. But thanks to an innovative Kickstarter, you'll be able to recreate this effect on your current TV. The Dream Screen has an HDMI throughput module that captures the colours at the edge of the movie or game you're playing and will throw that colour pattern onto the wall behind your TV using a series of LEDs that you stick to the back of the screen. In a dark room, the results should look pretty impressive but we'd be curious to see how well it actually works in person.

TOYOTA I-ROAD

AU PRICE TBC | TOYOTA.COM

This tiny electric car has motorcycle blood in its veins. It's a three-wheeler that's just three feet wide, and is designed for one person in its little cockpit (there's a back seat, but it's unbelievably cramped for two people). The key thing, though, is how fun it is — the car literally leans into corners, so you can take them smoothly at speed, even though it looks like a weird, ungainly tall beast. The lean angle is controlled by the car (so you don't need to judge the leaning angle yourself), and it's ideal for city use, parking in tiny places and zipping through the streets. It's expected to cost around US$10K.

ANYLINK

FROM US$20 | MYJUBY.COM

There are too many cable types. Between phones, cameras and different PC connector types, we're totally lost — but AnyLink makes things much simpler, enabling you to connect pretty much any USB to any other USB no matter what the connection type is. The basic cable has USB-A on one end, but with a slide-out adapter for micro-USB. On the other end is a standard micro-USB connecter, but with an attached Lightning adapter. On top of that, you can get USB-C adapters, and even female USB-A adapters. It works for charging or data, is ideal for traveling, and comes in two colours.

FLEYE

€1,250 (ABOUT AU$1,985) | GOFLEYE.COM

This soccer-ball-sized, camera-equipped drone has the potential to be very smart indeed. The basic model comes with a dual-core processor that runs Linux, and can be loaded with new 'apps'. These can be simple tasks, such as taking a panorama using its 5-megapixel camera — but it's also compatible with facial-recognition programming libraries, so how about an app that has the drone follow you around, filming in 1080p? It's safe, too — its flight mechanisms and electronics are all enclosed, so no risk of a propeller in the eye. Its video results look really impressive, and it's pretty cute. ■

technotes

One reader likes his Raspberry Pi-powered laptop so much he's nicknamed it 'Kermit'

PI-POWERED LAPTOP

HAT TIP TO GLASSWIRE

Come on, have your say!

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ISSUE 06

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The extended warranty sham

Warranties may not be so necessary after all... but that doesn't mean retailers won't try to sell you one. Shaun Prescott investigates.

Spending money in the 21st century is arguably easier than it's ever been, but it's also a lot more complicated – especially if you find yourself in a position where you need to hold someone accountable for a faulty product. Purchasing from overseas retailers is its own kettle of fish with its own knotted, impenetrable logic, but buying in your local Harvey Norman, JB or Good Guys isn't so straightforward either.

According to a new report published by Choice, which saw shadow shoppers contact various retail outlets on the question of whether a $2,000–$3,000 TV could be returned for repair after an extended period of time, 48% of the retailers contacted offered incorrect advice. In Australia, we're entitled to return a faulty TV to a retailer – even after the manufacturer's warranty has expired. In fact, the report points out that, in some cases, purchasing an extended warranty isn't sensible – no matter how much pressure the retailer applies. 95% of salespeople spoken to by Choice's shoppers offered an extended warranty.

Meanwhile, retailers commonly told the shadow shoppers that the store wasn't accountable at all, passing the buck to the manufacturer. The shoppers were also told that the repairs would come with a price tag, or that they wouldn't look at it at all unless an extended warranty was purchased.

Given the ubiquity of warranties, it's common for consumers to believe these periods represent a solid limitation on when they can expect to receive free support for their product, but a quick glance of the ACCC website proves that this is far from the case. In fact, under Australian consumer laws, post-warranty support is a requirement for both retailers and manufacturers, with only a handful of exceptions. If you just change your mind, for example, those guarantees do not apply. If the product is faulty due to misuse, the seller has no obligation to fix the problem. And if you bought an item with explicit advice regarding its faults, you can't get a refund or repair for them.

The consumer law guarantees do account for most likely situations, though. If there's a minor problem with an item, the retailer is responsible for its repair, and so long as the repair is carried out, no exchange is necessary. If the problem is major, a replacement is required. Importantly, all items – including large ones like flatscreen TVs – must be shipped at the seller's expense.

Choice's findings aren't cut and dry: it's possible that salespeople are simply uninformed about Australian consumer laws where their managers might have a better understanding. Still, it's best to understand your rights, and it's not hard to access them either: in fact, the ACCC website (**www.accc.gov.au**) is unexpectedly straightforward for a government website. Make sure you use it.

ENDUSER

Share your stories!

If you have an iteresting story about technology users, their experiences and the issues that affect us all (whether funny or serious), email us at **apcmag@futurenet.com**. All correspondence becomes the property of *APC* and is subject to editing. Letters must include writer's full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.

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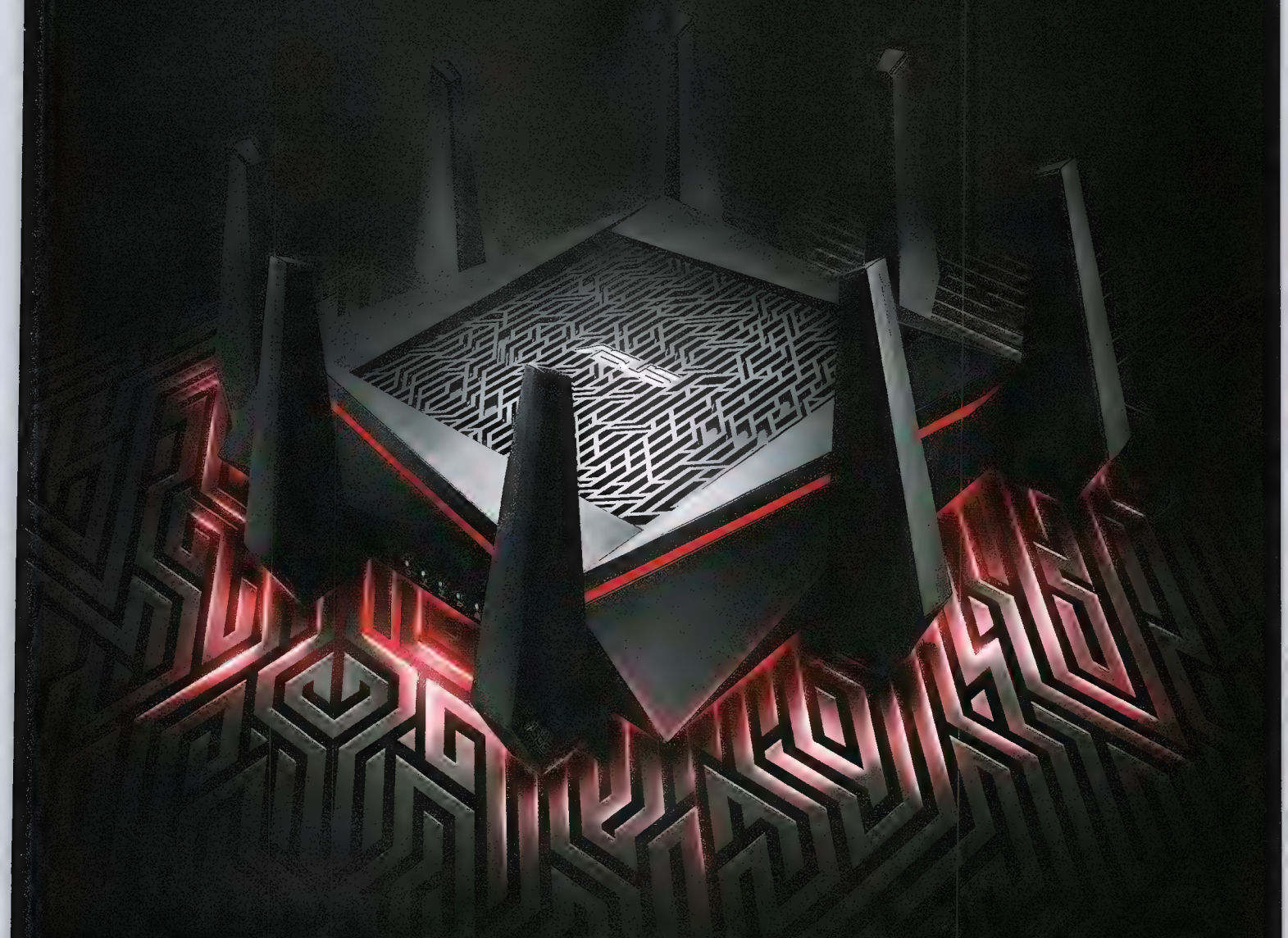

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ASUS Australia & New Zealand

Google Nexus 5X

What makes a phone good? Repairability, that's what..

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iFixit is a global community of tinkerers dedicated to helping people fix things through free online repair manuals and teardowns. iFixit believes that everyone has the right to maintain and repair their own products. To learn more, visit **www.ifixit.com**.

BACKGROUND:

It's been a couple of years since Google unveiled its last 5-inch smartphone, the Nexus 5, and a lot has changed since then. One thing remains constant, though – we're still tearing down Nexuses as fast as they (in this case, LG) can make them! Today, we're looking at the Nexus 5X. Will the 5X earn the same high marks? Join us round the teardown table as we find out!

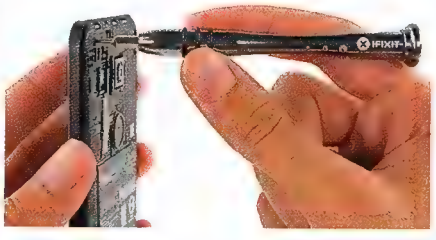
MAJOR TECH SPECS:

- 1.8GHz Qualcomm Snapdragon 808 hexa-core 64-bit processor with Adreno 418 GPU and Android Sensor Hub
- 12.3MP/4K rear camera with laser-assisted autofocus and 5MP front-facing camera
- 2GB LPDDR3 RAM with 16GB or 32GB internal storage
- 5.2-inch full HD 1920 x 1080 IPS LCD at 423ppi
- USB Type-C port with support for fast charging
- Nexus Imprint fingerprint scanner
- Android 6.0 Marshmallow

KEY FINDINGS:

- Google's latest Nexus sports a reversible USB-C charging port alongside the headphone jack. However, despite the fancy new look, it only supports USB 2.0 transfer speeds – like the OnePlus 2. Bummer. What's not a bummer is the increased charging speed (5V/3A) the USB-C port provides.
- Just like its older sibling, the 5X uses clips to secure the rear case to the rest of the phone. The similarities end there, though, as the adhesive strips found on the Nexus 5's rear case are nowhere to be found in the Nexus 5X. LG seems to have gotten the message about our feelings on adhesive.
- Our spirits soared as we spied the 2,700mAh battery sitting in plain view – a removable battery is hard to come by these days. Some light adhesive secures the battery, but it's nothing that a little spudgering can't handle.
- Piggybacking on the midframe is the Imprint fingerprint reader. Google claims it can recognise a fingerprint in just 600ms – quick enough to skip the lock screen entirely. Flipping the Imprint over reveals an unidentified control chip and our favourite – spring contacts! These are much more durable than traditional connectors that snap into place, and they're much easier to work with during repairs. Win win!
- Similar to the LG G4, the USB-C port is soldered to the motherboard. Unless you know how to microsolder, you'll need to replace the motherboard if the port fails.
- Repairability Score: 7 out of 10 (10 is easiest to repair). Many components are modular and can be replaced independently. Standard Phillips screws mean a driver is easy to find. The battery isn't immediately accessible but isn't too challenging or too adhered to replace. Fused display assembly – glass and LCD need to be replaced together if either breaks. ■

No adhesive strips makes getting into the 5X a dream.



All the screws are Phillips heads – thanks LG!

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apc RECOMMENDS

GAMING LAPTOP
$3,599 | WWW.ACER.COM

Acer Predator 17 (G9-791)

Does this 17-inch laptop have what it takes to tackle more established gaming-laptop players?

Though you might be inclined to shrug off the names computer companies give to their gaming laptops, the Acer Predator may just be the exception to this general rule. Unashamedly large, extremely powerful and housing more fans than a wind farm, it can hunt down and play games at a quality you'd normally believe was only possible on a desktop gaming PC.

In many ways, the Acer Predator looks exactly how you'd expect – it's big and gaudy, with a red-backlit chiclet keyboard, a blue-backlit number pad and red accents on the directional and WASD keys. But the refined quality becomes obvious in elements like the visual presets shortcut buttons, powdery matte-black skin, red aluminium fan grills and one of the most exceptionally responsive and nice feeling trackpads we've come across – which can be quickly disabled if you're using a mouse.

The Predator's Intel Core i7-6700HQ chip ran rings around all of the general home and work benchmarks we threw at it, and with 32GB of memory and Nvidia's GeForce GTX 980M graphics processor, it even made mincemeat out of the general graphical benchmarking tests we put it through.

Though there is the usual 3.5mm audio-out jack for connecting up headphones, the Predator also houses an inbuilt 4.2-speaker surround sound system, with a speaker at each corner of the device and two subwoofers that combine to give you directional auditory information in games and surprisingly good quality audio.

The Killer Doubleshot Pro dual networking ports will prioritise your networked gaming data to run exclusively over the Ethernet connection, while all other online info flows through the remaining Wi-Fi port. You do also get Acer's Predator Dust Defender software, which lets you automate fan flow reversal to prevent dust buildup, and the optical drive can even be swapped out for another fan.

Although we are starting to see gaming laptops at this price-point emerge with 3K screens, like the Aorus X5 reviewed in the November issue (p22), it's by no means commonplace, and at 17 inches, you still won't see higher than 1080p. As such, the Predator's 1,920 x 1,080 IPS LCD is perfectly adequate and will let you run games at higher frame rates with more bells and whistles.

When it actually came to gaming performance, the Predator scored higher than anything else we've tested with a single dedicated GPU, smashing titles that are a couple of years old on 1080p Ultra presets. And adding further veracity to the Predator name, it did all this stealthily – well, the fans were at least only audible when within two meters, under general office audio conditions.

Yet, despite all this power, this beast actually has a decent amount of stamina too. You can stretch almost three hours of battery life from the Predator when using it for home-related tasks, a somewhat surprising result for something with this amount of grunt.

When you consider it's reasonably priced for something with a top-of-the-line quad-core 6th-gen Intel chip and a Nvidia GTX 980M GPU, and that some bulk is to be expected from a 17-inch gaming laptop, we really can't think of any glaring faults with this apex predator. **Joel Burgess**

Verdict

Features	★★★★½
Performance	★★★★★
Value	★★★★☆

An excellent no-compromise gaming heavyweight, but one that cost's a pretty penny.

★★★★☆

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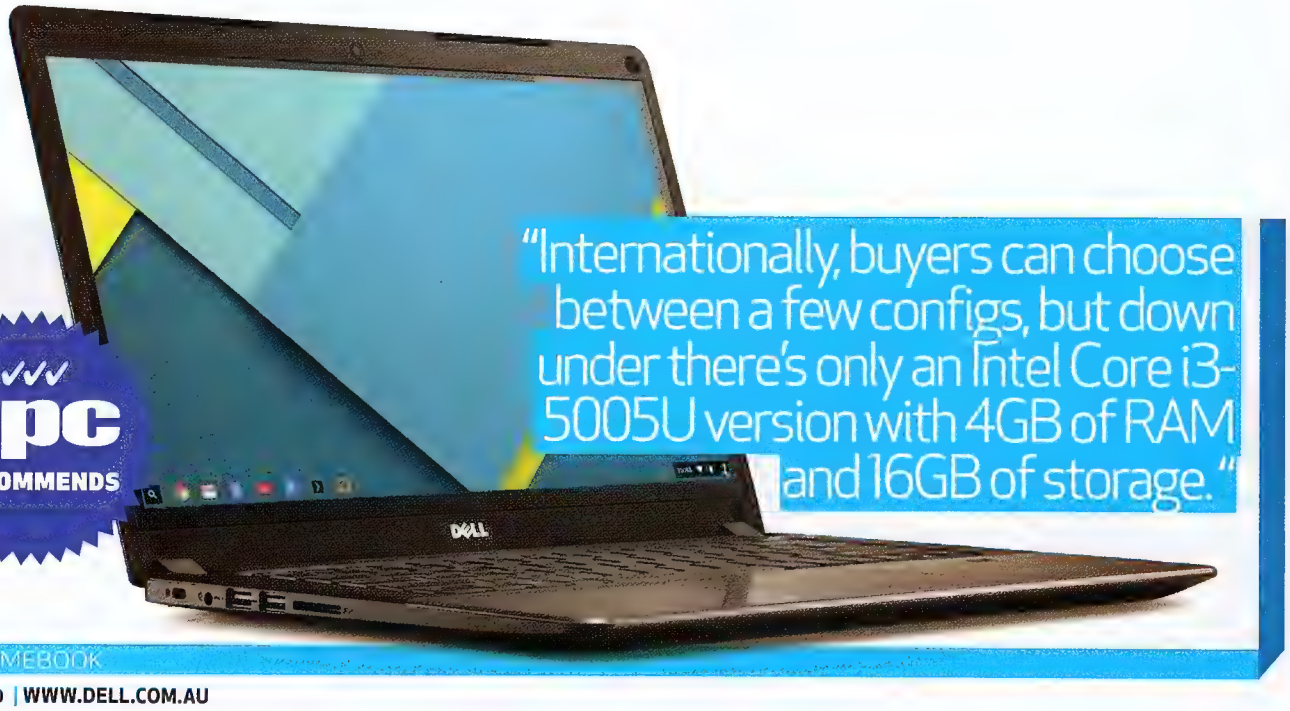
apc
RECOMMENDS
"Internationally, buyers can choose between a few configs, but down under there's only an Intel Core i3-5005U version with 4GB of RAM and 16GB of storage."
DELL

CHROMEBOOK

$969.10 | WWW.DELL.COM.AU

Dell Chromebook 13

A Chromebook from Dell that really means business.

Unlike rival makers, Dell is targeting specific niches with its Chromebooks. The Chromebook 11 was aimed at the education market, and this year, Dell is back with a larger, more premium model for enterprise users.

The Chromebook 13 competes in the same space as the metal-clad Google Chromebook Pixel and ASUS's stunning Chromebook Flip. However, unlike these consumer-grade offerings, Dell's powerful Chromebook 13 is packed with enterprise-grade VPN software, mobile management and deployment tools and virtual desktop software.

Not only does the 13 come with enterprise-ready software, it also looks the part. Actually, it looks like a mashup of Dell's XPS 13 and Latitude 12 7000, with a woven carbon fibre design on the lid, like the XPS 13 and Latitude, to help reinforce and protect the screen.

Opening up the lid, you find a large glass trackpad and metal keyboard deck constructed from magnesium alloy with chiclet-style backlit keys. (The keyboard is full-sized, but the individual keys appear slightly smaller than the keys on a MacBook Pro – reminiscent of the keyboard on the Latitude 12 7000 Series.)

To continue its metal build, a sheet of aluminium wraps the undercarriage of the notebook, where you also find a set of bottom-firing speakers. The hinge is built into the body, in a design very similar to the hinge on a MacBook Pro, and concealed behind the hinge are the cooling vents.

Internationally, buyers can choose between a few configs, but down under there's only an Intel Core i3-5005U version with 4GB of RAM and 16GB of storage on offer, though the latter can be augmented with an SD card. There's no touchscreen locally either: we looked at the 13.3-inch anti-glare version with a Full HD 1080p resolution screen. (It's unclear at this stage if the touchscreen version will be released down under, but it uses Gorilla Glass to protect it from scratches.) Dell uses an IPS screen on both models, providing for wide viewing angles.

A game-changer is support for a range of desktop virtualisation software, enabling you to run Windows on Chrome OS. With support for Citrix, VMWare and Dell Wyse, you can virtualise Windows 7, 8 or 10 on your Chromebook. In our tests, Citrix took a while to launch Windows 7 Enterprise over the office Wi-Fi. Once it was up and running, programs were quick to open.

Dell is bringing its enterprise savvy to take what some see as a lightweight consumer operating system into the corporate environment. It faces stiff competition from cheaper consumer-class devices including Acer's Windows-powered Cloudbook and other inexpensive Chromebooks available.

At the entry-level and mid-level configurations, the Dell Chromebook 13 makes for a compelling alternative to Google's Chromebook Pixel. Taking the package as a whole, Dell might be on to a winning formula.

Its managed mobility solution makes it easy for IT managers to deploy and manage Chromebooks, and tested support for VPN connectivity and virtualised desktops makes it possible for corporate users to get their Windows fix too. ■

Chuong Nguyen

Verdict

Features	★★★★½
Performance	★★★★
Value	★★½

The options for virtualisation and management could make this a game changer, albeit a pricey one.

★★★★☆

2-IN-1 LAPTOP/TABLET

$1,200 | WWW.ACER.COM

LABS BENCHMARK RESULTS

General system performance

PCMARK 8	HOME (SCORE)
ACER ASPIRE R 14	2,975
MICROSOFT SURFACE PRO 4*	2,873

0 1000 2000 3000 4000 5000

CINEBENCH R15	OPENGL (FPS)
ACER ASPIRE R 14	38.36
MICROSOFT SURFACE PRO 4*	36.85

0 10 20 30 40 50

CINEBENCH R15	CPU (MULTI-THREADED)
ACER ASPIRE R 14	276
MICROSOFT SURFACE PRO 4*	306

0 100 200 300 400 500

CINEBENCH R15	CPU (SINGLE-THREADED)
ACER ASPIRE R 14	108
MICROSOFT SURFACE PRO 4*	107

0 30 60 90 120 150

Gaming performance

3DMARK	ICE STORM UNLIMITED (SCORE)
ACER ASPIRE R 14	59,885
MICROSOFT SURFACE PRO 4*	60,070

0 20k 40k 60k 80k 100k

Battery life

PCMARK 8	HOME (HRS:MINS)
ACER ASPIRE R 14	4:27hr
MICROSOFT SURFACE PRO 4*	3:48hr

0 1 2 3 4 5

* CORE I5 MODEL WITH 8GB RAM.

Acer Aspire R 14 (R5-471T-53MU)

Can this bigger 2-in-1 succeed as both a laptop and tablet?

Two-in-one PCs – devices that combine a laptop and tablet – are one of the brighter sparks in the current PC market, and over the last three years, every major PC-maker has piled on with their own takes on how to design one... meaning there's now an almost overwhelming number to choose from.

Acer's latest mid-range 2-in-1 isn't quite brand-new – this Aspire R 14 is actually an updated version of a similar model we reviewed around nine months back in our sister mag *TechLife*. The older model was different in that it had a discrete Nvidia GPU and 'Playbook' in the name, sort of indicating that this was a device geared towards entertainment. This new model relies on Intel for its GPU (the HD Graphics 520, which is incorporated into the Core i5-6200U processor) but is otherwise much the same from a general-design standpoint. The screen is mounted on a smooth and sturdy 360° hinge, so switching between laptop and tablet just requires you to keep pushing that display around until the lid is touching the base. The flexibility and sturdiness of that hinge mean you can use it completely flat or popped up like a tent.

The chassis construction is a reasonably-pleasing plastic/aluminium mix: the top of the lid and palm-rest area under the keyboard are both metal, while the underside is a matte-black soft-touch plastic. Acer has switched from a gunmetal-grey finish to a cleaner and slicker polished-black, which looks much better to our eyes, and the body's even a little slimmer, down from 23.8mm to 18.5mm.

There are quite a few useful improvements under the hood, too. Acer has upgraded the OS to Windows 10 and replaced the mechanical hard drive with an SSD, making programs faster to launch and Windows a little snappier. The 14-inch display is now a full 1080p and there's a Type-C USB 3.1 port on the left side of the keyboard (it still has two USB 3.0 ports and one 2.0). The keyboard and trackpad are both great, too – big enough that even those with bear-claw hands won't find anything to complain about. We do wish the chiclet keys had a bit more throw, but there's nothing deal-breaking here.

The unit's main design problems still remain, however. The R 14 isn't a very good tablet, for a few reasons. For one, even though it's a little lighter than last year's model, it's still too heavy. At 1.9kg, this is not a device that invites you to hold it with one hand and tap away at with the other: it needs to be nestled in the crook of your arm, or better yet, plonked down on a table.

Our other gripe is with the screen bezel, which leaves a sizeable frame around the display – it's big enough that it feels like you could squeeze a 15.6-inch panel in.

Those shortcomings don't make the R 14 a bad 2-in-1, but they hold it back from being a great one. Still, it's hard to deny the value on offer here – at about $1,200 on the street, it's $300 cheaper than its predecessor and packs in enough improvements to make it worth considering.

Dan Gardiner

Verdict

Features	★★★½☆
Performance	★★★★☆
Value	★★★★☆

Acer's latest 2-in-1 packs good specs and value, but some design niggles persist.

★★★½☆

apc RECOMMENDS

ROUTER

$439 | WWW.ASUS.COM

ASUS RT-AC5300

Do you really need a tri-band router?

Like other so-called 'tri-band' routers, ASUS's chunky, mediaeval-styled RT-AC5300 reaches its claims of 5,300Mbps transfer speeds by adding up the individual speeds of its three radios. In this case, that means a 1,000Mbps 802.11n radio plus two 2,167Mbps 802.11ac ones.

ASUS has been one of the more aggressive brands when it comes to rolling out higher-speed AC gear, with additional spacial streams (or blocks) increasing speed. We saw the 1,734Mbps RT-AC87U last year, and two new routers (this unit and the dual-band RT-AC88U, which we reviewed in *APC* 424) now promise 2,167Mbps speeds through a bit of proprietary Broadcom Wi-Fi tech called NitroQAM. The AC5300 still technically has a 4x4 MIMO radio setup, meaning it combines four spacial streams to achieve its 2,167Mbps speeds. Rather than the standard speed of 433Mbps per stream, NitroQAM basically overclocks each of those up to about 542Mbps, which when combined give you that 2,167Mbps result.

Now, while all those high numbers might look cool on a spec sheet, they're not often as useful in real-world scenarios. The problem is that there are few client devices can actually use these kinds of speeds – it's still rare for laptops, tablets or smartphones to have more than 2x2 433Mbps setups (i.e. 867Mbps), so having 2.5x that is arguably a bit of a waste. To get 2,167Mbps, you'll basically need to be using another ASUS router to connect to this one, forming what's called a wireless bridge between the two.

And in fact, that's exactly how we tested this unit, switching ASUS's own RT-AC88U into bridging mode.

The bad news is: we had difficulty getting – and moreover maintaining – those top speeds. While we did occasionally see spikes up to 1,950Mbps, the signal more commonly sat at around 1,625Mbps, even with the routers just 3m apart with a clear line of sight. And on 867Mbps client devices, like our 2013 MacBook Air, transfer speeds peaked at the same 55–60MB/s that we see on most other 802.11ac routers.

Now, that doesn't make the RT-AC5300 a bad device – just an expensive one with a rather specialised claim to fame. Running ASUS's custom router OS, the features on offer blow most other brands' high-end routers out of the water, with useful connectivity to ASUS cloud services and unique options like a built-in VPN client (that makes anonymising your whole network easy) and a great status page that lets you see what's happening with the router at a glance.

Those OS features are all available on the RT-AC88U, however, so it's worth seriously considering if you really need the extra 2,167Mbps radio that this one offers over the latter. There are situations where this AC5300 might be a better option – like in very busy, multi-device wireless environments where you constantly need to transfer lots of data – but few homes or offices will qualify.

Most people will probably be better off saving a bit of money and opting for the ASUS RT-AC88U instead.

Dan Gardiner

Verdict

Features	★★★★½
Performance	★★★★½
Value	★★★½

Great features and fast speeds, but a bit pricey.

★★★★☆

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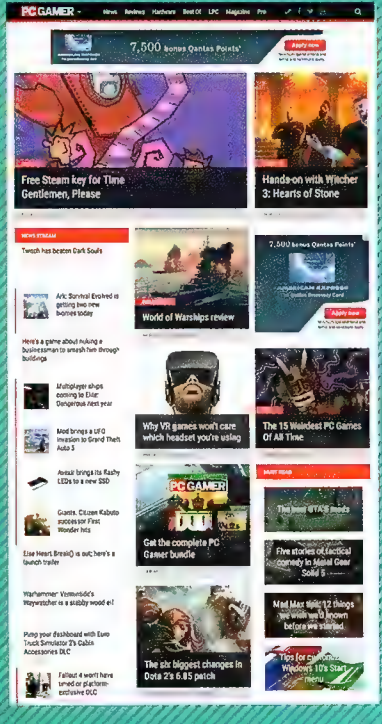
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"Considering that the Chromebit's frame is about the size of a Mars Bar, ASUS has managed to pack quite a reasonable bit of power under the soft black hood."
chrome
apc
RECOMMENDS

MINI-PC

$158 | WWW.ASUS.COM/AU

ASUS Chromebit

The Google-powered PC that'll fit in your pocket.

While there have been screenless stick PCs around for a couple of years, the concept has only just started to catch on with mainstream vendors, driven perhaps by the rise in popularity of streaming services and the increasing sophistication of cloud-based productivity suites.

ASUS's Chromebit is one of that handful of big-name computer sticks available today, and despite its middling price tag in this novel category, having access to the established Google Chrome ecosystem makes it a surprisingly appealing little device.

Considering that the Chromebit's frame is about the size of a Mars Bar, ASUS has managed to pack quite a reasonable bit of power under the soft black hood. This is essentially basic smartphone fare, with four Cortex-A17 cores running at 1.8GHz, allowing the Chromebit to output video at up to 4K, a feat that the latest Apple TV can't even achieve. 2GB of RAM adds to the already decent processing power and does a lot for the overall system responsiveness. Bluetooth 4.0, 5GHz Wi-Fi and a USB 2.0 port round out the hardware in this surprisingly well-equipped little PC stick.

Despite Google owning Android – a platform that's arguably an excellent OS for micro-PCs – the search company has been running with Chrome OS on its budget PC hardware since the release of the first Chromebook back in 2011. This has given Google the time to tweak and refine its lightweight Linux-based OS, which draws heavily on the Chrome browser and Google's own cloud-based products.

Chrome OS uses your Google account – or requires you to create one if you don't already have one – and uses this to sync specific apps, extensions and settings to the device. Because the inbuilt storage is only 16GB, having the additional 100GB of Google Drive cloud storage that's bundled with the Chromebit is an important aspect of this device's storage system. Google Drive – and even third-party cloud storage services like Dropbox and OneDrive – are baked directly into the Chromebit's file explorer, making it easy to swap between file sources, find items and utilise the flexibility of the cloud at the same time.

We were impressed by the Chromebit's excellent integration with Google's browser-based office products (Docs, Sheets and Slides), but if you're not already a fan of the Google cloud ecosystem or have no intention of using it, it's worth pointing out that the Chromebit doesn't really support any other alternatives.

From a broader perspective, the desktop environment is laid out in a familiar fashion, with an app launcher in the bottom left corner and the date, Wi-Fi status and settings down the bottom right. The desktop itself is actually just a wallpaper and won't let you place app icons or shortcuts directly on it.

Unfortunately, there's nowhere to set up a pin code to unlock your device, so you have to punch in your whole Google Account password each time you log in.

Though its app store is reasonably comprehensive for what's essentially a browser add-on library, it's not in the same league as what you'll find on say, Android. If it does what you need, those gripes are a bit inconsequential.

Joel Burgess

Verdict

Features	★★★★
Performance	★★★★
Value	★★★★

The first in what we hope will be a fruitful new PC segment.

★★★★

"Physically, the Remix Mini is about the size of your average portable hard drive, but despite that, this flat little PC manages to pack in a surprising number of external connections."

apc HOT PRODUCT

MINI PC

US$70 | JIDE.COM

Jide Remix Mini

Remixing Android into a lounge-room PC.

If anyone ever decided to put together a campaign to promote the merits of Kickstarter's crowdfunding system, then Jide's Remix Mini may well just be the ideal poster child. After raising over US$1.6 million in August last year, the company was shipping units by November, with the bulk of backers receiving their device before Christmas. Part of this success came from a well-designed, well executed business plan, but the other aspect – the one that helped them find 22,000 backers – was the high demand for a budget-priced, living room-friendly PC.

Physically, the Remix Mini is about the size of your average portable hard drive, but despite that, this flat little PC manages to pack in a surprising number of external connections including an audio jack, HDMI port, microSD card slot, two USB 2.0 ports, Ethernet and a DC power input. When you compare this to the reduced connectivity of other portable HDMI computers like Intel's Compute Stick (*APC 417*, page 28) or the new ASUS Chromebit (this issue, page 26), having that extra USB port, microSD card slot and Ethernet connection is a major leg-up. There's 802.11n Wi-Fi built-in, too.

All this is run via one of Allwinner Technologies's more recent 64-bit ARM processors: a quad-core 1.2GHz Cortex-A53. There's actually two versions of the Mini – a 1GB of RAM and 8GB of storage, or 2GB RAM and 16GB of storage. In terms of hardware, that makes this a relatively bare-bones system, but when you remember it's being sold for US$70, the Remix Mini starts to seem exceptionally resourceful.

But the real magic of the Mini lies in Remix OS: an Android 5.0-based architecture that has been sculpted into a desktop-like OS that we find far more appealing than the Chrome OS used in ASUS's Chromebit. There are a few reasons for this; first and foremost being the big difference in the number of apps available. Chrome OS relies on browser extensions (some of which are admittedly quite sophisticated), but when you stack that up against a more full-featured OS, it comes off a distant second. The Remix Mini's other major distinguishing factor is that it has a well-designed local storage system and file explorer – that's in addition to third-party cloud storage access via Android apps.

Remix OS offers a ton of other little things that make us preferred it over Chrome OS, like being able to store apps and files on your desktop; Alt-Tab between windows; pin half or full-page apps to the edge of the screen; interact with, format and eject external storage devices; and launch or open apps and files without having to go through Chrome's weird launcher system.

At times, the Remix Mini's hardware limitations do show, however; you'll see the occasional high-res video stutter or a little lag when using multiple apps. The other unfortunate limitation is that it will only output the display at 1080p, despite the fact that its CPU can decode 4K video.

In use, we did experience a couple of issues when streaming Netflix (which the devs are apparently working on), but the rest of the Android apps we tried worked well, despite Remix OS's more traditional Windows-style interface.

In all, our experience with the Remix Mini was refreshingly positive.

Joel Burgess

Verdict

Features	★★★★★
Performance	★★★½
Value	★★★★★

A flexible, budget-priced living room PC that should show Google how much Android outpaces Chrome in this space.

★★★★½

$220 | WWW.CORSAIR.COM

Corsair Carbide 600C

Inverted motherboard tray, silence optimised: What's not to love?

Constructing a chassis is a complex affair – finding exactly the right design style, including the perfect feature set, and matching the ideal price point is always a balancing act. So this is the 600C, Corsair's latest addition to its Carbide line-up.

Generally speaking, these have primarily been optimised for silence. Quite a shock, then, to see this windowed edition make an entrance. The same sound-dampening material is embedded into the front of the chassis, with just a smidge more lining the 5.25-inch bay covers. On top of that, the feet have a nice 10mm or so of rubber on the base.

This Corsair case features an inverted motherboard layout. It's also the first Corsair chassis outside of the Carbide Air series that includes a semi-compartmentalised design. The PSU, SSDs and hard drives are all hidden away above and behind the motherboard tray, or sneakily disguised, thanks to that snazzy-looking top PSU cover. There's no doubt that this is going to make for one hell of an argument on the web. It certainly goes against the norm, especially for reference design cards. In our opinion, however, it's a far more innovative and interesting design style than the standard ATX variants we usually see. Cooling support is still solid, though you do lose out on those two additional 120mm fans.

Despite being limited for custom loop watercooling, this case is ideal for those looking for a hassle-free and easy build. The only downside we can see beyond that is the lack of storage options. ■ Zak Storey

Verdict

Fantastic finish; brilliant windowed panel; sound-dampening chassis; solid airflow; innovative design.

★★★★½

$189 | WWW.BEQUIET.COM

Be Quiet! Silent Base 800

Fantastic noise canceling, but could do with more modularity.

Since 2008, Be Quiet!'s ethos has been about one thing: silence-optimised computing, which means it wasn't a huge surprise when Be Quiet! announced its first iteration of a sound-dampened PC chassis.

The 800's steel chassis houses sound-dampened side panels constructed of a plastic polymer, as is the bottom. The interior layout touts some solid modularity. Once you remove the rear panel, you're greeted with ample cable management space, with the back of the motherboard tray also housing two 2.5-inch drives.

As for cooling, well, if water-cooling is your game, the Silent Base has room for a 240mm or 280mm radiator in the roof and the front of the chassis, with plenty of space for push-pull. And if that's not enough, you could always throw another 120mm rad in the rear.

There's no doubt that the 800 is a competitive chassis. However, in an incredibly loud market, we're just not sure whether this Germanic case can create enough uproar to be heard.

However, the build quality of the panels still harbours a plastic construction and feel, leaving the strength of those panels somewhat wanting, and the modular capacity doesn't feel like a fully flexible ATX chassis.

That aside, the addition of rubber mounting on all of the hard drive bays, and the inclusion of the premium Be Quiet! fans, is definitely a plus. What would have been impressive was if Be Quiet! had included an integrated fan hub to help control the vast array of cooling options you have at your disposal.

But the 800 is deafeningly quiet and certainly a good option. ■ Zak Storey

Verdict

Great noise dampening; strong SSD-mounting solution; anti-vibration mounts; premium fans.

★★★½

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apc RECOMMENDS

VR HEADSET

$159 | WWW.SAMSUNG.COM/AU

Samsung Gear VR

The final, retail version of the Korean smartphone-king's mobile-VR headset offers competent virtual reality on the go.

We've been dreaming about virtual reality for years, but while we'll have to wait for the release of the crème de la crème of modern VR, you can get a good taste of it with Samsung's Gear VR.

Made in partnership with Oculus VR, the Gear VR is a headset attachment for modern Samsung phones, with support for the Note 5 and S6 series devices. We tested ours with Samsung's S6 Edge. The headset is mostly plastic; inside are optics that magnify and refocus your eyes on your phone's screen. The phone locks into place via a micro-USB connector, with foam padding around the face plate.

Once you lock your phone in place, it automatically engages VR mode, and you can navigate menus using the headset's physical back button and four-way directional touchpad on the right. Inside the headset, you have access to roughly an 80–90-degree field of view. Tracking is pretty much 1:1. When VR experiences are done well, the headset is able to trick your brain into believing that your body is somewhere else. Of course, the experience isn't perfect. With the S6 Edge's 1,440 x 2,560 screen, you can still make out some of the pixels.

There's a wide variety of content, ranging from games to movies and beyond, and a lot of it is free. In terms of games, most of them have you using your head to look at targets in a shooting gallery. This can quickly start to feel shallow and tiring. Because Gear VR is running on Android, don't expect Crysis-level graphics. There are some fun VR games, however, such as *Land's End* and *Omega Agent*, and there's also an app that throws you into a virtual arcade where you can play old-school games.

Even if gaming isn't your thing, there is a ton of 360-degree photos and videos to view, and you can even watch 2D movies in a 3D environment. There's a movie theatre app that enables you to watch any movie you have on your phone in various three-dimensionally fleshed-out environments. Netflix also has a VR app. Virtual tourism is another big component, and there's a healthy number of experiences that take you scuba diving with sharks or ringside at a fight. There is also the social app.

However, the Gear VR quickly drains the phone's battery, and overheats the device. But the biggest issue is motion sickness. It's better than the Oculus Rift development kit 2, but if the experience isn't well optimised, you're going to get a little dizzy. Also, the Gear VR and your phone can feel a bit heavy after extended use.

Despite these problems, if you have a capable Samsung phone, getting the Gear VR is a no-brainer at $160. There's a decent amount of content already, and we're confident it will only continue to increase. The big question is whether people who are currently content with their non-Samsung smartphones should jump aboard. Unless you're a die-hard VR enthusiast, we suggest holding off until gen two. Hopefully, by then, it will have a faster refresh rate, wider FOV, and perhaps some integrated speakers. This additional time will also allow the Oculus store to make some UI improvements and bolster its library. If you have a compatible phone and are at all interested in VR, though, gear up for a good time! ■ **Jimmy Thang**

Verdict

Features	★★★★½
Performance	★★★★
Value	★★★★

Have a Galaxy S6/S6 Edge or Note 5 and interested in VR? This one's a no-brainer.

★★★★

$130 | WWW.DOGANDBONECASES.COM

Dog & Bone LockSmart

A Bluetooth-enabled keyless padlock with very few drawbacks.

Padlocks have always been pretty straightforward; however, the advent of smart home tech has opened the door to a number of ways in which they can evolve to provide expanded functionality and ease of use. With that in mind, Dog & Bone has developed the LockSmart – a keyless Bluetooth padlock that can be unlocked from your phone.

The LockSmart's hefty body has a tough stainless steel shackle and a die-cast Zamak-3 zinc alloy body, giving the padlock high tensile and impact strength. It's also weather-proof, so leaving it out in the rain, hail or extreme cold is not an issue.

On the bottom of the lock is a red rubber flap which opens up to reveal a micro USB port for charging. While a padlock that needs to be charged isn't ideal, a full charge will last you an impressive two years. It'll also notify you when the battery is getting low.

The device is controlled via Dog & Bone's LockSmart app (available for both iOS and Android), and can be unlocked via a tap of your screen, a passcode or via the most secure method, Touch ID (or Fingerprint on Android phones).

You can also share unlocking privileges to up to 50 people, and you'll receive notifications whenever they've opened the padlock. The app also gives you an Activity Log of each unlock.

While we did experience the odd connection issue (usually due to multiple users attempting to access the lock simultaneously), the LockSmart truly is the perfect solution to all of our first-world padlock problems.

Stephen Lambrechts

Verdict

Though it's pricey, it's a reliable device that will change the way you look at padlocks forever.

★★★★☆

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$199 | WWW.BRYDGEKEYBOARDS.COM

BrydgeAir for iPad Air

Might play second fiddle, but still a first-rate ipad keyboard.

When a keyboard clocks in at over double the price of most others, you'd be right to ask if the investment is worth it. The BrydgeAir is a stick-on model that's less about protection and more about function. There's no actual case for your iPad, but the device does have more features than the ClamCase, like dual speakers and backlit keys. Entirely aluminium, the BrydgeAir is still a little weighty, though, tipping the scales at 520g; as much as an iPad Air.

Installing the device is fiddly, though your iPad does remain firmly in place once done, courtesy of the two silicon rubber-lined, clamp-shaped hinges.

The keyboard is frankly great – easily one of the best iPad add-ons we've ever tested. Right off the bat, you can expect to be typing just as fast and as accurately as on a regular (albeit small) laptop keyboard. The feel of the spring-loaded keys will be familiar if you're a Mac user, and the backlit keys add to the overall usability. Don't expect theatre-quality audio, but the speaker can provide a much-needed volume boost if your iPad's speakers just can't keep up.

The keyboard itself is set towards the front edge of the base, which doesn't leave any room for a wrist rest. This takes some getting used to when using the BrydgeAir on the go. The keyboard doesn't rotate beyond 180° either, so your iPad can't easily be converted for presentations or traditional tablet usage, so you'll need to be prepared to flex your muscles to remove and reinstall the keyboard if you're often switching between uses.

Rah Gardiner

Verdict

It's a little fiddly to get on and off, but the BrydgeAir still offers outstanding typing on your iPad.

★★★★½

$199 | CLAMCASE.COM

ClamCase Pro for iPad Air

Turn your iPad into a mini MacBook with this outstanding keyboard case.

The ClamCase Pro is designed to turn your iPad into a MacBook substitute. That sounds like a tall order, until you actually insert an iPad into the polycarbonate case. Within minutes, you'll be inadvertently tracing your finger on the aluminium keyboard base, expecting a trackpad to be there.

The iPad is easy to install, sitting securely in the case without obstructing the hardware buttons or camera. Establishing a Bluetooth connection is swift during setup, then instantaneous any time the case is opened up. Typing is a joy, thanks to the layout of the keyboard and the higher profile of the keys – sitting quite tall compared to cheaper iPad keyboards.

It weighs in at 680g, a noticeable addition to your load. The bulk of the ClamCase's weight is in the keyboard base; the upper part of the case feels light and flimsy by comparison but does the job.

Usage on the run is where the ClamCase shines. Sit the case on your lap on the bus and the iPad won't slip out. Balance it on the edge of a tiny table at a coffee shop and still type at full speed. Prop it on the handrail as the lift stops on every floor while you bash out a quick email. Rotate the keyboard 360° to sit behind the iPad and use it as a traditional tablet. Claims of 100 hours' uninterrupted in-use time should mean months between recharges – we never had to plug it in during our month-long test period, despite daily use.

The one caveat? Be prepared to be asked, "Is that the new MacBook?" a lot, as the ClamCase garners a whole lot of attention.

Rah Gardiner

Verdict

Just about transforms your iPad into a mini MacBook, but is still easy to remove when not wanted.

★★★★½

AOC

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SMARTPHONE

$529 | WWW.OPPO.COM/AU

Oppo R7s

A good oppo-tunity to score a big phone for less.

We quite liked Oppo's R7 back when we reviewed it in APC 420. The $450 mid-range smartphone offered great bang for buck, with a high-quality build, slick interface, good balance of processing-power and an all-day battery life.

With its new mid-ranger, the Chinese smartphone maker has seemingly taken a leaf out of Apple's book, adding an 's' to the name. If you were expecting this to just be a faster version of the R7, however, you'd be mistaken. While the physical design is quite similar, this new model is a little bigger, taking the 5-inch 1080p AMOLED screen up into 5.5-inch phablet territory.

The other main additions are an extra gig of RAM (now 4GB) and double the storage, now a more comfy 32GB. You can still add a microSD card to that, too (up to 128GB), although you'll have to forgo the R7s's second SIM slot. In terms of CPU and GPU, they're identical to the R7: a mid-tier Snapdragon 615 and Adreno 405 combo that amply covers the basics.

One of the big appeals of the R7 was it's sturdy feel and that's thankfully been reproduced here, with the very solid aluminium-magnesium frame wrapping around the outer-edge, and Gorilla Glass 4 protecting the screen. Its large 3,070mAh battery lasted an excellent 8:07hr in PCMark for Android's battery test, and the phone even supports fast-charging.

In short, if you liked the look of the R7 but prefer a bigger handset, this one's got a lot of appeal – and it's well worth the extra $80 or so that Oppo's asking.

Dan Gardiner

Verdict

A bigger, but not faster, version of the already appealing Oppo R7. What's not to like?

★★★★☆

SMARTPHONE

$1,199 | WWW.SONY.COM.AU

Sony Xperia Z5 Premium

The world's first 4K smartphone... kinda.

Sony has taken a very clear strategy for its Z5 smartphones: offer a size for every taste – small (Z5 Compact), medium (Z5) and large (Z5 Premium). This 5.5-inch Z5 Premium is designed to take on the likes of the iPhone 6S Plus, and Samsung's Galaxy Note and Edge+ devices.

It definitely feels premium in the hand, with tempered glass front and back and a polished metal frame wrapping around the outside edge. It weighs in at 180g.

The Premium's best features are all available on the smaller Z5s: fingerprint sensor on the power button, fast charging, microSD slot (supporting cards up to 200GB) and a 23MP, f1/2.3 camera. It's also water- and dust-proof.

Sony's main pitch with the Premium is that it's the world's first 4K smartphone, with a screen resolution of 3,840 x 2,160-pixels, making the screen 806ppi. But while that screen can technically display that many pixels, most of the time, Sony's got it turned down to only 1,920 x 1,080 – the same resolution as the smaller Z5s. The display only actually switches to 4K resolution in very specific circumstances – when showing photos or videos in Sony's own applicable apps. To be honest, it's hard to see the benefit of 4K on such a tiny screen.

The battery life was disappointing. When you push it, the Z5 Premium will die quicker than other flagships. It lasted just 5:12hr in PCMark for Android – 70 minutes less than the Z5 – and just 7:41hr in web video-streaming, two hours less than average.

The Xperia Z5 is still our recommendation if you want one of Sony's latest.

Dan Gardiner

Verdict

Premium feel, but too much compromise for us to heartily recommend it.

★★★½☆

software

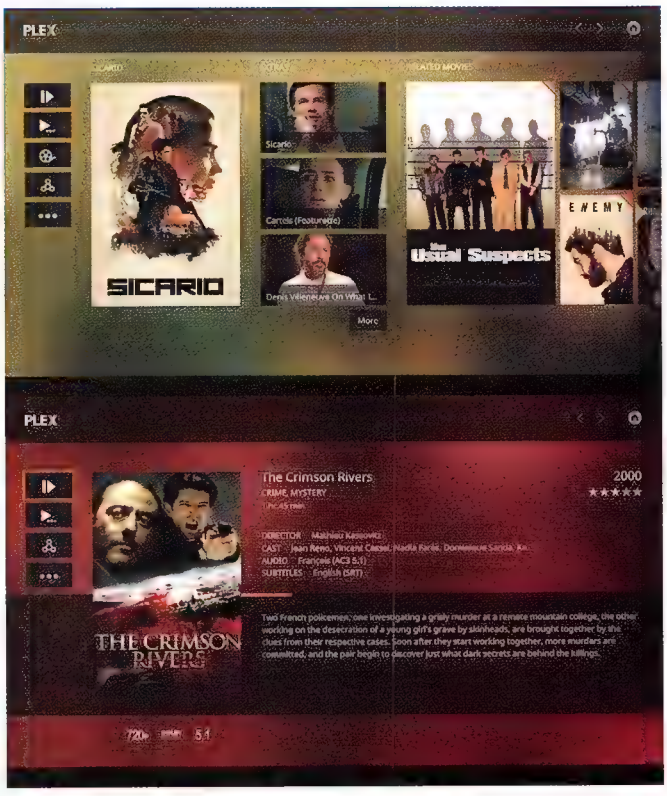
» APPS FOR ALL THE PLATFORMS

Windows SOFTWARE

Plex Media Player

Plex's devs go back to the drawing board for their new front end.

FREE (CURRENTLY IN SUBSCRIBER-ONLY PREVIEW) | WWW.PLEX.TV



We've made no bones about the fact that Plex is our favourite media library and playback option here at *APC*, mainly because it makes it easy to watch your entire media collection on just about any device (and with a super-polished interface to boot). This new app is intended to replace the aging Plex Home Theatre, the company's Windows and Mac front-end design for use on (you guessed it) home-theatre PCs.

Despite the friendlier name, this isn't a general-purpose media playback app – you still need to sign into a Plex server to actually locate and play videos (or browse photos or listen to music), so unless all your videos are on your Plex server, you won't be able to ditch VLC just yet.

So what's new? Well, this is a new app that's been rewritten from scratch, including a new media player at its heart (the open-source mpv) that supports almost every video file out there, plus there's a faster-performing and slicker-looking interface and broader control support. As before, you can use a gamepad or a Windows remote to navigate, but there's also a mouse pointer now, too, making it a bit quicker and easier to use on your desktop or laptop.

While PMP is technically at version 1, at the time of print, it was only available to Plex Pass subscribers. It felt near-final to us, so it should hopefully be available to users of Plex's free tier, too. Plex is still our favourite media server, and this new client makes it a both bit more flexible and attractive to use. Oh, and there's even a custom-OS version available for the Raspberry Pi!

Dan Gardiner

BlueStacks App Player

FREE | BLUESTACKS.COM

Android is a pretty amazing OS that's been able to tie together an enormous range of smartphone manufacturers thanks to its mostly open-source nature. While it may be first-and-foremost built for smartphones and tablets, Android is now getting to a point where you might actually want to run it — or at least an emulation of it — directly on your computer. And whether it's to play your favourite smartphone game or you simply want to use an Android app that isn't available on your PC, BlueStacks App Player gives you access to the entire Android ecosystem directly on your desktop.

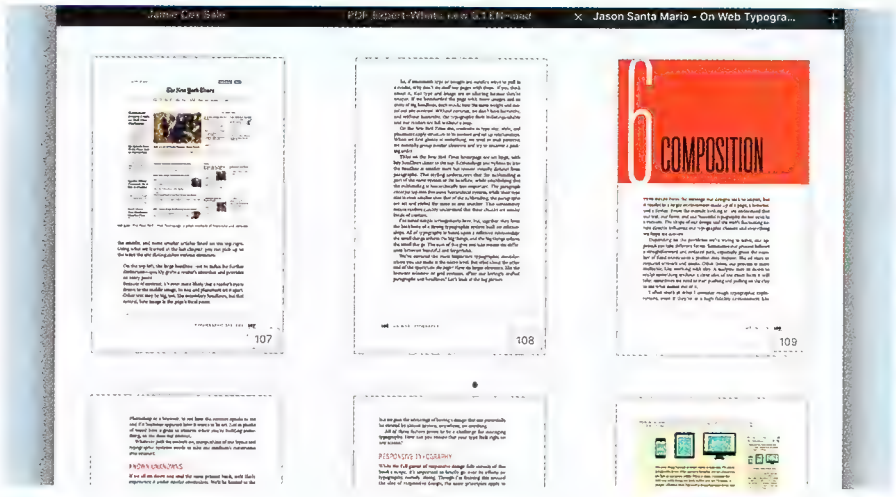
Much like on a new Android device, after installing Bluestacks, you're initially required to log into your Google Account in order to download apps from the Google Play Store. Once through this initial setup, you can download games and apps or reclaim the ones you've already purchased using your Google Play account and, unlike some other alternatives, you can even use these apps when you're offline.

The app itself is structured very much like the Google Play Store, showing a locally ranked list of popular downloads in an interactive browser-like window. But there's an additional toolbar that runs down the left side of the Bluestacks window, providing useful 'smartphone' actions that your computer might otherwise struggle to complete, including flipping the screen orientation, 'shake to undo' and taking a screenshot.

We had some trouble with the window becoming too large when flipping the screen orientation on a Microsoft Surface Pro 4, and the apps toolbar often gets lost off the edge of the screen. For the most part, however, Bluestacks is easy to use, launches and runs Android apps well and integrates nicely with the Google Play Store.

With over 100 million users, there's a decent community to offer troubleshooting help and give feedback to the developers. If you've ever thought that you'd like a particular Android app on your PC, then this free emulation-app is a mostly hassle-free option to try.

Joel Burgess



PDF Expert

The popular PDF app finally makes the move from iOS to the Mac.

$30.99 | READDLE.COM

Mac developers have been jumping to iOS ever since Apple first opened the App Store in 2008, but an increasing number of mobile-only developers have been doing the opposite in recent months. The one with the most potential is Readdle, which is already synonymous with quality iPhone and iPad productivity apps. Its PDF Expert app has long been the gold standard for filling in forms, or signing or annotating documents on iOS devices. A piece of truly impressive 'desktop-class' software, its power and performance has finally reached the Mac.

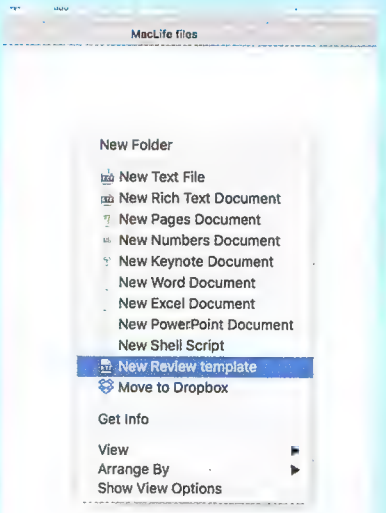
If you've used PDF Expert for iOS (or its free version, Documents), you already know what to expect. Documents open in a flash, and even enormous files with high-resolution graphics zoom and scroll with buttery smoothness. Multiple documents can be opened as tabs, and you can pick up from the exact page where you left off next time the app is opened.

Apple's built-in Preview already does some of this – along with annotation and document signing – for free. But, with its intuitive user interface, PDF Expert offers a more robust solution than Preview and a more affordable offering than the reigning PDF heavyweight, Adobe Acrobat Pro DC.

Most of the action is instigated from three buttons: the first opens a thumbnail view of the current document, where individual or multiple pages can be moved, rotated, deleted, or extracted; the second reveals a sidebar for browsing bookmarks, outlines or annotations; and the third is for editing and adding text, shapes, stamps or notes. Signatures can be added by typing or scribbling on a trackpad, but sadly there's no way to import scans of existing signatures for cleaner results – not a huge problem, but it's a noticeable omission.

Other key features missing include inline text editing and form creation, both of which are promised to be delivered as free updates for existing customers. We feel that Readdle should also consider advanced object editing, audio and video support, and the ability to directly scan paper documents into editable digital ones. They would truly make this a PDF powerhouse able to compete with Adobe's top-tier app.

PDF Expert for Mac is every bit as good as its sister iOS app, with a slick interface and lightning-fast performance. The app is already superior to Preview, and all that remains are a few additional pro features to make it a contender for the throne occupied by Adobe's expensive desktop powerhouse.



New File Menu

$2.99 | LANGUI.NET

New File Menu is a brilliant little utility app that can take away one of the potential areas of friction when using your Mac.

It adds the ability to create new files to the contextual menu in Finder (or on the desktop), so all you need to do is right-click to be able to make a fresh document. By default, it gives you options for new text documents, iWork documents and Microsoft Office documents — but the key thing is that you can expand on this list. Open up the app properly (most of the time, it will be invisible in the background) to go into its preferences and you can remove file options you won't use, but you can also add ones based on files that already exist; so you could use an invoice template, for example, and then just create new invoices with a right-click. When you create a file, you give it a name, and you can decide whether created files should open immediately. And it all works great! Our only minor complaint is that it would be nice to be able to limit certain file options to certain locations (so you only get the option for your invoice template in your 'Invoices' folder, for example).

A really cheap, useful utility that we already love!

Matt Bolton

SUN **21 JUNE 2015**

At Milton Keynes Central, Ozone Coffee Roasters, British Library, Cutty Sark, The Shard and The Happenstance with Sara, Paul, Jason, Philippa and Carl tagged coffee, food, view, drinks and dinner.

4.6mi 0.6mi 1.5mi

Momento — Diary/Journal

Carpe diem, and then journal it.

$2.99 (FREE 'CLASSIC' VERSION AVAILABLE) | MOMENTOAPP.COM

Momento has been reimagined from the ground up for its third major release and offers a visually rich user interface. It's now less a competitor to manual journaling apps such as Day One and more of an automated repository for content extracted from Facebook, Twitter, Instagram, Swarm, Moves and even Uber.

The new timeline is a consolidation of each day's photos, mentions and tags. If you frequently cross-post to multiple social networks, however, repetition quickly becomes a problem. New images are saved directly to the device's Camera Roll, so if they're deleted from there, they also vanish from Momento. The developer plans to restore local photo storage with version 3.1, but we'd suggest taking things a step further by integrating cloud services such as Dropbox. Journal entries are backed up via iCloud, but currently without any photos or videos.

Surprisingly, Momento 3 launched without native iPad support. There's also no way to import or export data.

Despite the shiny new UI, Momento 3 is collectively a disappointment for existing users, who are being forced to pay for reduced functionality.

JR Bookwalter

Project Office Pro

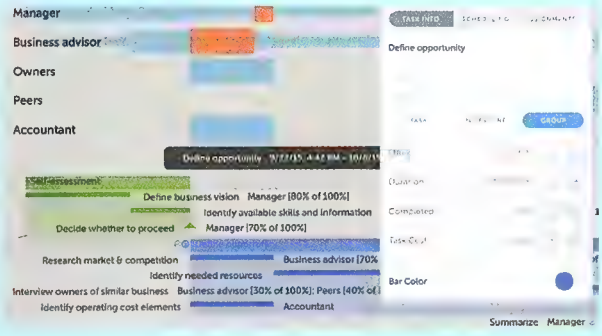
$38.99 | WWW.PRODUCTIVITY-CODE.COM

Gantt charts — a bar-chart-style breakdown for serious scheduling — packs a lot of data into a compact space, making it ideal for devices like the iPad. Featuring a more elegant, intuitive user interface than competing apps, Project Office Pro is more affordable than popular alternatives such as OmniPlan. Built for speed, the app makes it easy to juggle multiple projects, assign contacts or materials, track any remaining work to be done, and head off potential bottlenecks at a glance.

Up to three copies of each project can be backed up via iCloud, although this has to be initiated manually. Project Office Pro lacks any comprehensive way to collaborate on a project with others, although projects can be sent via email or saved in PDF format; more traditional HTML task or resource reports can also be generated or shared with other apps.

Unfortunately, Project Office Pro lacks a tutorial to help novices get up to speed (there is basic in-app help, however). It's iPad-only for now, too, but an update with iPhone support should be available by the time you read this.

JR Bookwalter


Manager
Business advisor
Owners
Peers
Accountant
Define opportunity
Define business vision Manager [80% of 100%]
Identify available skills and information
Decide whether to proceed Manager [70% of 100%]
Research market & competition Business advisor [70%
Identify needed resources
Interview owners of similar business Business advisor [30% of 100%]; Peers [40% of
Identify operating cost elements Accountant
Bar Color
Summarize Manager

Ferrite Recording Studio

FREE WITH IAP | WWW.WOOJI-JUICE.COM

Ferrite Recording Studio is a surprisingly strong app for editing podcasts. On startup, it's just one tap to start recording using the built-in mic or anything you have plugged in, or dive into existing projects. Nearly every aspect of Ferrite is polished to make tools such as splitting tracks, removing silence and crossfading easy to use on the touchscreen.

We were thrilled at how easy it was to edit and clean up two tracks of a two-person episode. While the basic version of Ferrite is free to download, a number of useful features can be unlocked via IAP, such as noise gating and adding effects from other audio apps via Audio Unit Extensions.

However, we found it a little difficult to learn our way around. There isn't much introduction in the app, but a thorough user guide is available via a menu. Also because iOS offers no way to record two (or more) people to separate tracks using something like Skype, Ferrite cannot reach its full potential as a one-stop recording and editing powerhouse.

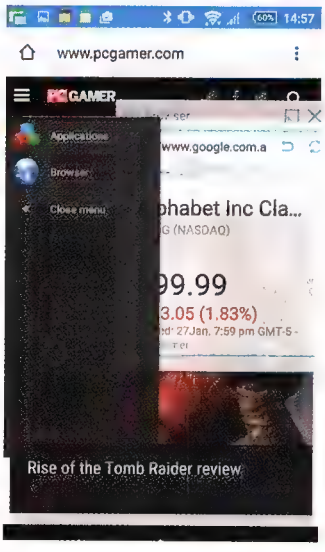
David Chartier

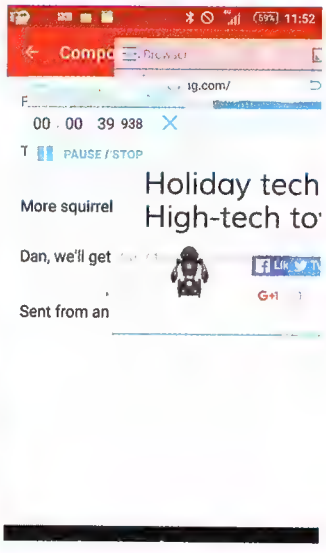
Floating Apps

Window of opportunity.

FREE WITH IAP | WWW.FLOATINGAPPS.NET

Floating Apps is primarily designed to run multiple apps simultaneously on your Android device's screen – much like having multiple programs open on Windows or OS X, or Samsung's multi-window Galaxy feature – but as a by-product, it also does a fine job of creating shortcuts, so you don't need to flick back to your home screen or app drawer. The blurb advertises being able to watch a video while browsing the web, but we found it most useful to have Gmail and the bespoke browser open. The free version only teases the concept by supporting a handful of apps (a flashlight, its own browser, a stopwatch), though if you're willing to pay for the full program (about $2.57), there are more than 30 on offer. On the one hand, it's a tidy solution for anyone who needs another app open while writing a note or email, but it suffers as the floating apps are their own apps, rather than running the Android programs within a dedicated window. And small screens need not apply – this is best for phablets and tablets. Paul Taylor

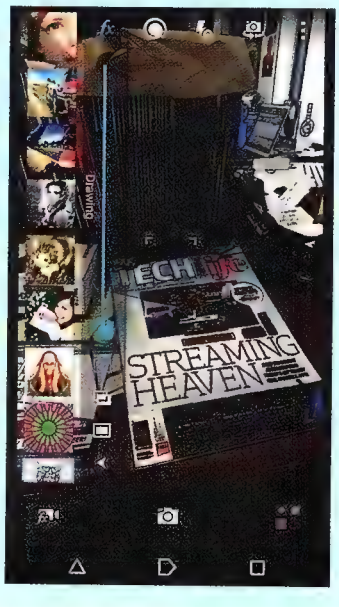




Camera MX

FREE WITH IAP | WWW.CAMERAMX.COM

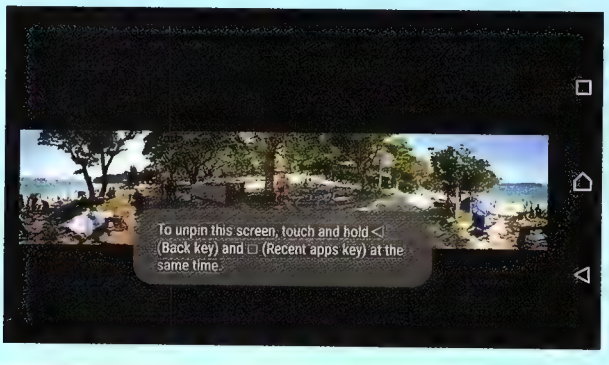
You'd think that, by now, the world would have perfected smartphone photography based on the number of apps available. Yet more and more are coming. Google Play's storefront is littered with Android photography apps, all of them with functions that are similar to the last, with a few tweaks and riffs thrown in. So it's pleasing to find something fresh — Camera MX is one of the best, as it's also gifted with original ideas. The biggest drawcard is its 'Live Shot', which records up to five seconds of footage before you press the shutter so you can find that perfect image when you 'rewind' while reviewing the shot. It's a feature found on Nikon's AW-1 tough camera, and having it on a smartphone is a no-brainer. There's the litany of pretty/gimmicky/tawdry (delete as required) effects, like pop-art or line drawing, and faux lens flares that have been popularised by Instagram, many that can be operated on-the-fly while shooting video. Recommended. Paul Taylor



Stop Swiping

FREE WITH IAP | TINYURL.COM/APC426-STOP

Stop Swipin! fixes two first-world problems: your rude mates and your embarrassing photo collection. Or, rather, people being able to view your entire photo collection when you hand them your phone to show one or two prime pics. The premise is simple: load up Stop Swipin! and then select the photos you're happy for your recipient to look at. The screen is locked to this ad hoc album, so there's no chance of the person looking at the pics to accidentally swipe past and view your awkward shots of prices in the supermarket, or people picking their nose on public transport (unless that's the album you want to show off). Once you're done and want to get the phone back to normal use, hold down both the 'back' and 'recent apps' keys. There's also an option to save the album, if you're likely to show off the same pics over and over (ideal, say, for a recent holiday or baby photos). The free version holds nothing back, though the pro version ditches the ads. Paul Taylor



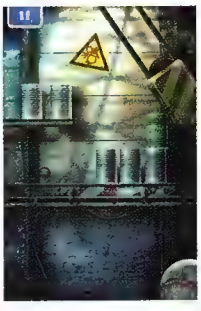
Can Knockdown 3

Take your best shot.

FREE WITH IAP | TINYURL.COM/APC426-CANK

While you might think that knocking over tin cans with a baseball is a pastime that's, well, past its time, game dev Infinite Dreams has reincarnated this old game into a surprisingly entertaining smartphone app.

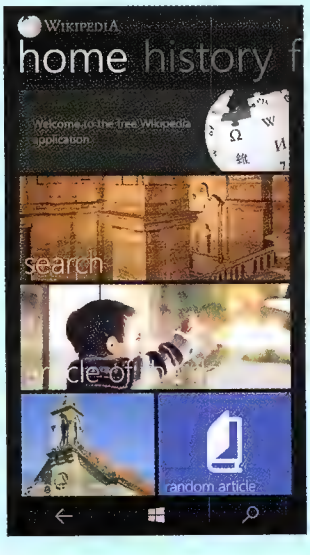
Can Knockdown 3 has recently been ported to the Windows Phone platform (it's been on Android and iOS for some time) and though many of the apps that actually trickle down to Windows Phone seem a bit half baked, this isn't one of them. The mechanics are simple – swipe up to throw one of your three baseballs at the stack of cans on a ledge – but the physics seems as though it's genuinely three-dimensional, adding to the realistic feel of this hard-to-master title. The overall look of the game is excellent too, taking on a grungy industrial vibe that mimics the warehouse and factory levels you move through. But the best aspect of the game is perhaps its well thought-out level progression and increasing level of difficulty, which help keep you hooked. It's a free title, but it's good enough to seriously consider forking out for the extra levels. **Joel Burgess**



Wikipedia

FREE | TINYURL.COM/APC426-WIKI

Wikipedia has been available on Windows Phones for some time, but what's become the most comprehensive encyclopedia on the planet has just received a serious facelift — in addition to some other nifty enhancements, most notably, it'll now allow you to interact with it via Cortana. The update officially adds Windows 10 support to the 7, 8 and 8.1 Windows Phone compatibility list, making it one of the most broadly compatible Windows Phone apps available. It also added Spanish, Dutch, Brazilian and German translations for those keen to absorb this resource in a different language. Version 2.4.1 isn't laid out that differently to earlier iterations with the familiar Home, History, Favorites and Settings sections. Though the latter three are probably self explanatory, the Home section features Article of the Day, Around Me and Random Article subcategories in addition to the usual the search section. It's a useful free addition if you're partial to a regular fact-check or topical deep-dive. **Joel Burgess**



SHAREit

FREE | SHAREIT.LENOVO.COM

Lenovo's file sharing app SHAREit, which facilitates easy file transfers over local Wi-Fi, has been available on Android, iOS and even Windows Phone for some time now. But with the arrival of Windows 10 for Mobile, the PC company has launched a new universal app and slapped an 'unofficial' label on the earlier version. That said, not that much has been updated in this new app and the Windows Phone version is still leagues behind the Android edition. Other than selecting one of eight fruit-themed avatars and punching in your device's name, there are really only two things you can do: send and receive files. Fortunately, the app does both of these well. There are three big tiles that make sending pictures, music or videos easy, and you can send documents from your OneDrive too. In order to share files, you'll need the app on each device involved, and though it can be installed on Android devices, we were unfortunately only able to get our Lumia's SHAREit app to talk to the PC. **Joel Burgess**

Let's Encrypt

Free, automated and open.

FREE | LETSENCRYPT.ORG

Let's Encrypt is a tool for organising secure access for web resources (domains) and is targeted for hosts, system administrators and generally for everyone who controls a web server, be it an enterprise-level node or a homepage in a local LAN. Let's Encrypt is released by Internet Security Research Group (ISRG), a California-based technology firm that receives sponsorship from both non-profit organisations like Mozilla and enterprise giants like Cisco.

While there have been other free SSL certificate providers in the past, they have had certain limitations and caveats, such as an uncertain licensing model for commercial use or significant maintenance overheads. Let's Encrypt is a better solution for trusted and transparent secure access to a web domain. The protocol behind the service is called ACME, and it's also open source and developed under an Internet Engineering Task Force (IETF) working group.

Let's Encrypt is a classic client-server tool, meaning that a machine where you're verifying your domains is the client and the ACME service is an authoring server. As an illustration, we can run the Let's Encrypt client to verify an example server manually:

```
$ letsencrypt --text --email
recovery@example.com -domains
www.example.com,example.
com,foo.example.com --agree-
tos --renew-by-default
--manual certonly
```

In the above command, we've provided a dummy email address for restoring lost account details and listed domain aliases that the Let's Encrypt client can authorise. This secret information will be stored in a directory like /var/www/html/.well-known/acme-challenge, so make sure that it exists (or create it with mkdir) and finally put the information produced by the 'letsencrypt' command there. Once you acknowledge that you've put this data in place, the ACME server tests the site. If the confidential information matches, Let's Encrypt will provide the certificate. When the verification is complete, /etc/letsencrypt will be populated with a configuration for the domain, along with the keys, certificate and signing request used.

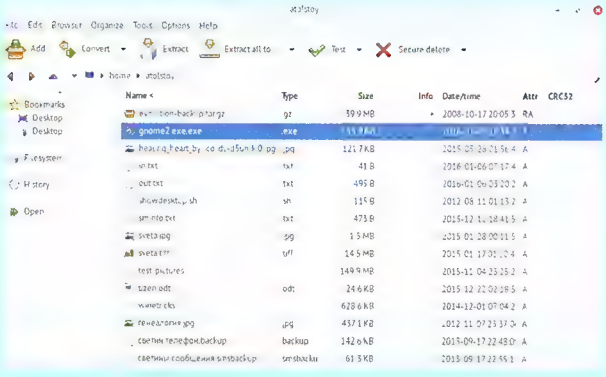
Alexander Tolstoy

PeaZip

FREE | WWW.PEAZIP.ORG

PeaZip is a front-end to P7Zip, a Linux port of the popular archive manager in Windows, 7-Zip.

The first thing you need to know about PeaZip is that it's distro and desktop agnostic, with both Qt and GTK builds available both at the project's website and in many mainstream Linux distros. More than that, PeaZip is offered as a portable build. You just download the zipped files, unpack it and run the $ ./peazip from its directory and PeaZip will launch without fuss. The main window resembles an average file manager, and in some ways, PeaZip does work as a file manager: it enables you to browse archives seamlessly as if they were plain directories.



Another power feature is the ability to use filters for browsing large archives. It's no secret that many other utilities only mimic 'transparent' browsing inside an archive; in the background, they need to unpack the archive onto a temporary place first. PeaZip is much faster in this regard, so you can safely open a large archive with the archive manager in a few seconds.

PeaZip has significantly evolved lately, for example, it currently supports as many as 188 archiving formats and, thanks to using the latest P7zip back-end, it doesn't require the UnRAR library to handle RAR archives anymore. There are also many auxiliary features, such as an image manager, advanced file checkers and analysers and password manager and so on.

PeaZip can also create self-extracting archives and even split them, and since it's a cross-platform application, it's capable of creating archives in EXE format in Linux. We checked if they were auto-extracted with Wine, and they work fine.

Alexander Tolstoy

THE
MOST FUN
YOU CAN
HAVE WITH
YOUR HANDS
WITHOUT
GOING
BLIND

games radar.
MORE KICKS PER CLICK

COMPACT PC PARTS ON TEST

APC ROUNDS UP THE BEST MOTHERBOARDS AND CASES FOR CONSTRUCTING YOUR OWN PINT-SIZED PC.

Mini motherboards compared

Who said bigger is better? Lindsay Handmer tests eight motherboards that prove you can still have it all in a compact package.

Bigger isn't always better, especially when building a new PC, and there is a big range of compact motherboards available. From low end desktops, to media PCs and even high end gaming systems, there is hardware to suit.

Mini-ITX boards are the smallest (170mm x 170mm), but often have to make some sacrifices, such as only a single PCIe x16 port. micro-ATX (mATX) boards are significantly bigger (244mm x 244mm), and can often be found for very affordable prices.

Connectivity options vary, but don't stress over slightly fewer SATA connections or USB ports – you probably don't need them all anyway. An M.2 port is a great way to add an SSD without needing a drive bay. Higher-end boards often have Wi-Fi and Bluetooth, but alternatively these can be added via an expansion card to other boards. All the models tested use Realtek Audio codecs, but the quality of the actual implementation is more important. For the best audio, consider S/PDIF and an external amp. Don't discount the free software bundles from the motherboard manufacturers – there are some excellent utilities available.

When comparing USBs, some boards offer USB 3.0 (up to 5Gbps), while others offer USB 3.1 with speeds up to 10Gbps. But the spec has been updated to say that 5Gbps speeds are USB 3.1 Gen 1 (the old 3.0), while 3.1 Gen 2 is 10Gbps. Few motherboard spec lists have moved to the new terminology, so we have stuck with USB 3.0 (5Gbps) and 3.1 (10Gbps) for this feature.

HOW WE TESTED

Socket LGA 1151 boards were tested with a Core i7-6700K. The B150 and H170 chipsets can't overclock, so a non-K CPU is a better bet. For X99, we used an Intel Core i7-5960X. With all boards, we used 8GB of Kingston DDR4 RAM. Cooling was handled by a Thermaltake Frio Silent heatsink. A Samsung 850 Pro SSD was used for testing consistency. A Gigabyte GTX 950 was the videocard of choice. Games were tested on high settings at 1080p.

$145 | WWW.ASROCK.COM

ASRock H170M Pro4

How does a cheaper mATX board compare?

As far as the more affordable mATX motherboards go, the H170M Pro4 has all the features you really need. For super-fast storage, there is a PCIe x4 M.2 socket (that supports NVMe boost disks), plus six SATA 6Gbps connections – though no SATA Express. You also get two CrossFire compatible PCIe 16x slots, plus two more x1 connections for other add-in cards. Up to 64GB of 2,133MHz RAM can be added as well, across four slots.

For a more budget board, the Pro4 manages to get plenty of performance from our test hardware. It's not designed for a high-end gaming machine, but is well suited for typical builds and has an easy-to-use but robust BIOS.

Sound quality is solid (but nothing especially amazing), using the common Realtek ALC892 codec, which supports 7.1 channels but no S/PDIF.

Round the back, the Pro4 has VGA, DVI, HDMI and DisplayPort, and can drive three monitors at once. It also has Gigabit LAN, a legacy PS/2 port and six USB 3.0 connections – two of both USB 2.0 and 3.0 ports are available from the internal headers. Giving a little extra value, ASRock bundles an array of pretty useable apps, such as a tuning utility and cloud connectivity.

If you want to save some money, the Pro4 is also available based on the B150 chipset. The major difference is no M.2 port, as well as no DisplayPort and fewer rear USB 3.0 connections.

Verdict

All the features you need for a budget build.

★★★★☆

$169 | WWW.ASUS.COM/AU

ASUS H170M-Plus

A step above the competition.

The H170 chipset is aimed at more affordable builds, but the ASUS model has a range of features not seen elsewhere. Most notable is the 5Gb/s capable USB Type-C socket on the back (which does 3A charging), which is becoming increasingly more widespread and useful. The H170M-Plus also comes with quite a range of software extras, such as fan control, a tuning utility and media streaming.

The board itself is pretty standard, using the mATX form factor and featuring two x16 PCIe slots that support CrossFire (in x16 x4 mode). You can plug in 64GB of 2,133MHz RAM across four slots and drop in two extra PCIe x1 expansion cards. For high-speed SSD storage, the Plus has a M.2 socket, SATA Express and six SATA 6Gbps ports that support RAID 0, 1, 5 and 10.

Round the back, the motherboard uses surge protected Intel Gigabit LAN and outputs video to a VGA, DVI or HDMI port. Aside from the Type-C port, the Plus also has two of both USB 3.0 and 2.0 connections, as well as four more of each available via internal headers.

As expected, the ASUS board performed flawlessly – there isn't a lot of variation across these Skylake boards. The ASUS BIOS is one of the best out there and caters to both advanced and beginner users. Audio quality is quite good, using the Realtek ALC887 Codec (and isolated components), but there are only three audio jacks, with S/PDIF available via internal header.

Verdict

Combines USB Type-C connectivity with a generally solid feature set.

★★★★☆

MICRO-ATX MOTHERBOARD

$160 | WWW.GIGABYTE.COM.AU

Gigabyte H170M-D3H

Time to build an mATX system?

In a sea of very similar motherboards, the Gigabyte H170M-D3H blends right in. But it does so in a really competent, no-nonsense kind of way. The specs are familiar – the H170 chipset, supported with up to 64GB of 2,133MHz DDR4 RAM across four slots and dual channels. Then a pair of PCIe slots that support CrossFire, and run at x16 and x4 speeds. For high-speed storage, there is a M.2 port that can run at up to x4 speeds, and handles the latest NVMe drives as well as SATA SSDs.

In other words, all the features you need. Performance is solid too, and the motherboard buzzed through all our benchmarks without a hiccup. The layout is good and there's plenty of room for different cooler types.

But Gigabyte does make a few efforts to stand out. You get two SATA Express ports (plus six SATA 6Gbps connections), DualBIOS and a range of free software utilities, such as one-click tuning, and more that are available from the app centre. The board uses the common Realtek ALC892 codec, with isolated components, S/PDIF and LED trace lighting, for quite a decent sound.

Round the back, you get VGA, DVI and HDMI ports (the latter of which can output 4K) which can run three monitors at once. It also has Intel Gigabit LAN, PS/2, four USB 3.0 ports, two USB 2.0 (and four more of each available via headers), plus six 3.5mm audio ports, for 7.1 channel output.

Verdict

A great all round board without going overboard on price.

★★★★☆

MICRO-ATX MOTHERBOARD

$149 | AU.MSI.COM

MSI B150M Mortar

This one's aimed at gamers.

The Mortar is designed to be affordable, but also provide features such as network management, reinforced PCIe slots and LED lighting to improve your LAN experience.

The Mortar supports 64GB of 2,133MHz DDR4, as well as CrossFire across two 16x PCIe slots. In spite of the relatively modest price, performance was still excellent. Of course, the i7-6700K we used for testing these boards is overkill, and the B150M is better suited to a more modest CPU.

The motherboard includes an M.2 slot, but it's not what you might be expecting. It's a Type-E connector, which means it's designed for high performance (PCIe x2) add-in cards, such as Wi-Fi, but can't handle an SSD. For storage connection, the Mortar has six SATA 6Gbps connections, as well as a single SATA Express port. You also get two PCIe x1 slots for other extras.

The Mortar uses MSI's Click BIOS 5, and while it doesn't have all the OC functionality of other chipsets, it's well laid out and simple to use. Audio is provided by the Realtek ALC892 Codec – an older but still quite good solution that has 7.1 channels and S/PDIF output.

The MSI board has four USB 3.0 ports round the back (and two USB 2.0), plus another two of each available on a header. You also get Gigabit LAN, plus VGA, DVI and HDMI outputs – the latter of which can do 4K resolutions.

The Mortar also has some decent free software utilities, such gaming macro keys, a bandwidth manager and customisable LEDs.

Verdict

An affordable, gaming-oriented option with good performance and features.

★★★★☆

MINI-ITX MOTHERBOARD

$399 | WWW.ASROCK.COM

ASRock X99E-ITX/ac

Not like the rest.

Mini-ITX boards are often used for lower-end media PCs, but some models are designed for pure performance. The ASRock X99E-ITX motherboard squeezes in the Intel X99 Chipset, which uses LGA 2011-v3 CPUs. We dropped in the Intel Core i7-5960X with 8GB of DDR4 RAM for testing, so the results are not directly comparable to boards with other chipsets.

The X99E does have to make some sacrifices in the name of size, so only has two (dual channel, 32GB) RAM slots and a single x16 PCIe port. You also get a x4 M.2 slot, SATA Express and six SATA 6Gbps ports.

To make life easier, ASRock includes a rather noisy but effective CPU cooler, as finding something that fits with this motherboard can be a challenge. Performance is excellent, though water-cooling (made easier with an included mounting bracket) is needed to get much more than a mild overclock from the stock setup.

The X99E comes with a 2T2R 802.11ac Wi-Fi card that plugs in via a mini-PCIe slot. Excellent audio is provided by the Realtek ALC1150 codec, with 7.1 channel and S/PDIF outputs.

Round the back are two USB 3.1 10Gbps ports, plus four USB 3.1 and two USB 2.0 connections. The motherboard also has dual Gigabit LAN ports (with teaming), PS/2 and eSATA. You also get an adaptor which allows the front of the case USB 2.0 ports to run at 3.0 speeds via an internal header.

Verdict

An amazing board for the right higher-end build, but otherwise overkill.

★★★½☆

MINI-ITX MOTHERBOARD

$220 | WWW.ASUS.COM/AU

ASUS B150I Pro Gaming WiFi Aura

How does the B150 chipset perform in a mini-ITX board?

The brand new Pro Gaming Aura from ASUS is designed as an affordable but feature-packed option for mini gaming PCs. The Aura has two RAM slots, for a total of 32GB of 2,133MHz DDR4, as well as a single x16 PCIe port. For high-speed storage, the motherboard has an M.2 on the underside. It's a little awkward to access in some cases, but takes full length 2280 SSDs and is a handy addition when building a compact PC. It's also got four SATA 6Gbps connections, but no SATA Express.

For an ITX board, there is still plenty of room around the CPU for chunky heatsinks or water-cooling. Performance is top notch – on par with the full ATX form factor B150 Pro Gaming Aura. It's also got the same funky RGB lights that can reflect CPU temperature, beat along to music or handle other user selectable effects.

The board also includes 2T2R 802.11ac MU-MIMO Wi-Fi, with a separate external antenna for better reception. Audio is provided by the Realtek ALC1150 Codec, with the generally excellent ASUS SupremeFX implementation.

Around the back, the Aura has PS/2, Gigabit LAN and two of both USB 2.0 and 3.0 connections, plus a Type-C port. Video is provided by HDMI and DVI, while audio has both S/PDIF and six 3.5mm audio jacks.

At the time of writing, the ASUS board was not yet for sale, but has an RRP of $249 and an estimated street price of $220. There's also a mATX version available.

Verdict

A well put together mini-ITX motherboard that doesn't blow the budget.

★★★★☆

MINI-ITX MOTHERBOARDS

$260 | WWW.GIGABYTE.COM.AU

Gigabyte Z170N-Gaming 5

Ready for compact gaming.

Opting for mini-ITX over mATX comes with some sacrifices, but the smaller size opens new build options. The Gaming 5 is designed to include all the features you need, without an over-the-top price tag.

At the board's heart is the Intel Z170 chipset, which supports socket LGA 1151 CPUs. You can plug in up to 32GB of dual channel 3,333MHz (OC) RAM, albeit only across two slots. The Gaming 5 also has a PCIe 3.0 x16 slot for a GPU, as well as HDMI (4K compatible) and DVI outputs for the onboard graphics. The board also has an M.2 x4 port on the underside that can handle SATA or PCIe NVMe SSDs. The location is a little awkward depending on case, but it has room for full-length 2280 drives. You also get two SATA Express and six SATA 6Gbps connections – a step up from most of the competition.

Round the back, the board has a USB 3.1 Type-C port, plus a standard 3.1 port, and three USB 3.0 ports. Two of both 2.0 and 3.0 spec connections are available via internal headers. The Gaming 5 has Gigabit LAN via a Killer E2201 chip, as well as a M.2 socket 1 802.11ac Wi-Fi card (dual band and antenna) with Bluetooth 4.2.

The Gigabyte board is well laid out and gives solid performance. The Realtek ALC1150 audio implementation is also particularly good, with 7.1 channel output and an isolated PCB.

Verdict

Great features with a better-than-expected price.

★★★★½

MINI-ITX MOTHERBOARDS

$279 | AU.MSI.COM

MSI Z170I Gaming Pro AC

Perfect for a LAN or lounge room gaming PC.

For those who want to build a very portable but still powerful gaming PC, the mini-ITX Gaming Pro AC is ideal. It uses the Intel Z170 chipset and supports full CPU and memory overclocking. Of course there are some sacrifices to be made for the small footprint – the board only has a single (reinforced) PCIe x16 slot. While the Pro has a PCIe x4 M.2 slot, it's mounted underneath the board and only takes SSDs up to 60mm long. While the access is no problem with the right case, cutting out 80mm M.2 SSDs does limit some of options available.

The MSI board has dual memory slots, for up to 32GB of overclocked DDR4. You also get four SATA 6Gbps and one SATA Express port, and support for RAID 0, 1, 5 and 10. Performance is hampered by the diminutive size either, and the Gaming Pro is more than capable of getting the best from your other hardware.

Round the back, the Gaming Pro has four USB 3.0, three USB 2.0, and two of each available via internal header. Graphics output is via HDMI or DisplayPort, both of which can do 4K resolutions. The motherboard uses the Realtek ALC1150 Codec to provide excellent 7.1 channel sound via 3.5mm jacks or S/PDIF output.

For gaming, the Pro has Intel Gigabit LAN (plus MSI's management software), as well as 802.11ac Wi-Fi for speeds up to 867Mbps. The latter uses the Intel 8260 chip, is dual band, runs two antennas and also has Bluetooth 4.2.

Verdict

High-end performance in a tiny package.

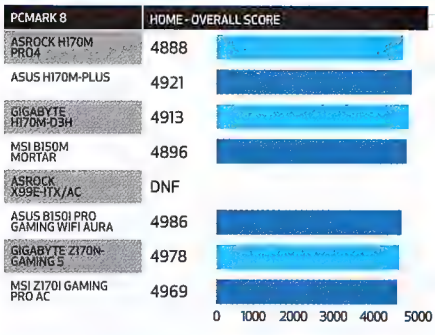
★★★★½

MOTHERBOARD SPECIFICATIONS

	ASROCK H170M PRO4	ASUS H170M-PLUS	GIGABYTE H170M-D3H	MSI B150M MORTAR	ASROCK X99E-ITX/AC	ASUS B150I PRO GAMING WIFI AURA	GIGABYTE Z170N-GAMING 5	MSI Z170I GAMING PRO AC
PRICE	$145	$165	$160	$149	$399	$221	$260	$279
FORM FACTOR	MATX	MATX	MATX	MATX	MINI ITX	MINI ITX	MINI ITX	MINI ITX
SOCKET	LGA 1151	LGA 1151	LGA 1151	LGA 1151	LGA 2011	LGA 1151	LGA 1151	LGA 1151
CHIPSET	H170	H170	H170	B150	X99	B150	Z170	Z170
RAM	64GB 2133MHZ DDR4	64GB 2133MHZ DDR4	64GB 2133MHZ DDR4	64GB 2133 MHZ DDR4	32GB 3200 MHZ (OC) DDR4	32GB 2133MHZ DDR4	32GB 3333MHZ (OC) DDR4	32GB 3600MHZ (OC) DDR4
PCIE	2X X16, 2X X1	2X X16, 2X X1	2X X16, 2X X1	2X X16, 2X X1	1X X16, MINI PCIE	1X X16	1X X16	1X X16
M.2	PCIE X4	PCIE X4	PCIE X4	TYPE E	PCIE X4	PCIE X4	PCIE X4	PCIE X4
SATA 6GBPS PORTS	6	6	6	6	6	4	6	4
SATA EXPRESS	NO	1X	2X	1X	1X	NO	2X	1X
LAN TYPE	GIGABIT	GIGABIT	GIGABIT	GIGABIT	DUAL GIGABIT	GIGABIT	GIGABIT	GIGABIT
BUILT-IN WI-FI	NO	NO	NO	NO	2T2R 802.11AC	2T2R 802.11AC	DUAL BAND 802.11AC	DUAL BAND 802.11AC
DISPLAY OUTPUTS	VGA, DVI, HDMI, DISPLAYPORT	VGA, DVI, HDMI	VGA, DVI, HDMI	VGA, DVI, HDMI	N/A	HDMI, DVI	DVI, HDMI	HDMI, DISPLAYPORT
USB 3.0 PORTS	6X (2 INTERNAL)	6X (4 INTERNAL)	6X (2 INTERNAL)	6X (2 INTERNAL)	2X 3.1, 2X 3.0	5X (2 INTERNAL)	5X (2 INTERAL)	6X (2 INTERNAL)
AUDIO CHIPSET	REALTEK ALC892	REALTEK ALC887	REALTEK ALC892	REALTEK ALC892	REALTEK ALC1150	SUPREMEFX	REALTEK ALC1150	REALTEK ALC1150
EXTRAS	PS/2	USB TYPE-C	GIGABYTE APPS	CUSTOMISABLE LEDS	CPU COOLER	USB 3.0 TYPE-C	USB 3.1 TYPE-C	STREAMING SOFTWARE

LABS BENCHMARK RESULTS

General performance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ASROCK X99E-ITX/AC DNF
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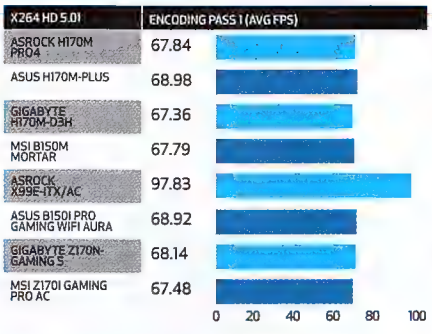
Encoding performance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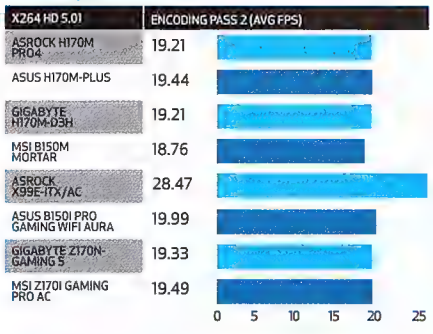
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ASUS B150I PRO GAMING WIFI AURA 19.99
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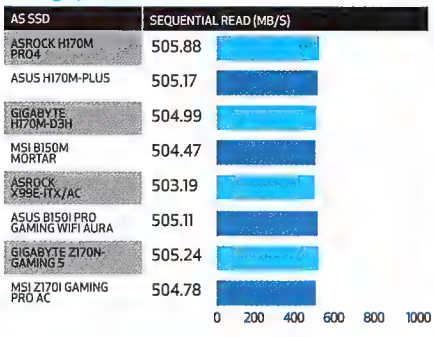
Storage performance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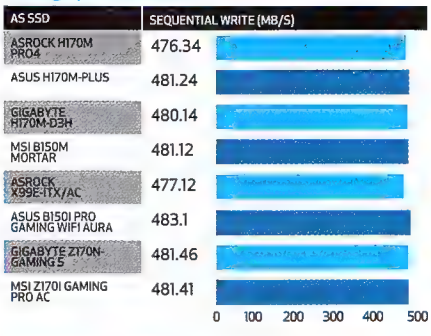
Storage performance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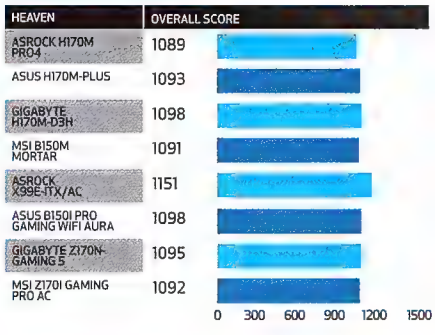
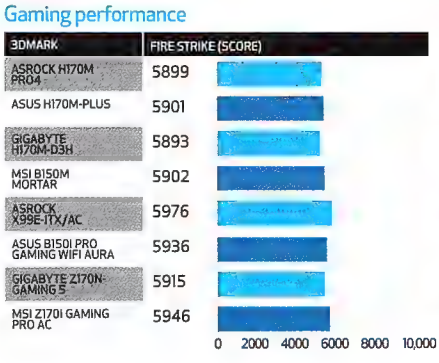
Gaming performance



Gaming performance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ASROCK X99E-ITX/AC 5976
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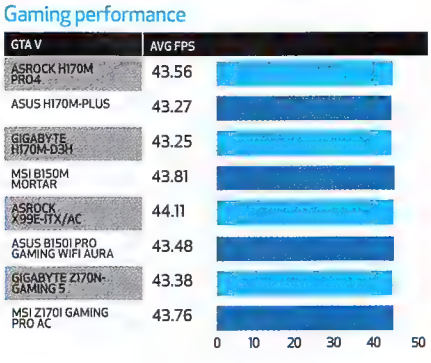
Gaming performance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AVG FPS
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ASROCK X99E-ITX/AC 44.11
ASUS B150I PRO GAMING WIFI AURA 43.48
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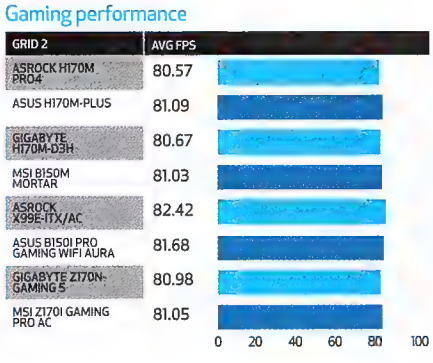
Gaming performance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0 20 40 60 80 100

PC cases get compressed

Need a home for your compact PC? Lindsay Handmer tests eight tiny towers in a wide variety of styles.

The days where a huge case is needed to build a powerful PC are long over. Micro-ATX and mini-ITX motherboards are common and affordable, with a large range across most chipsets. Likewise, manufacturers have flooded the market with chassis options, from gaming-focused models to ones suited to slim HTPCs. While it's possible to get very small options, we have stuck to models that can handle a standard ATX PSU and PCIe video card.

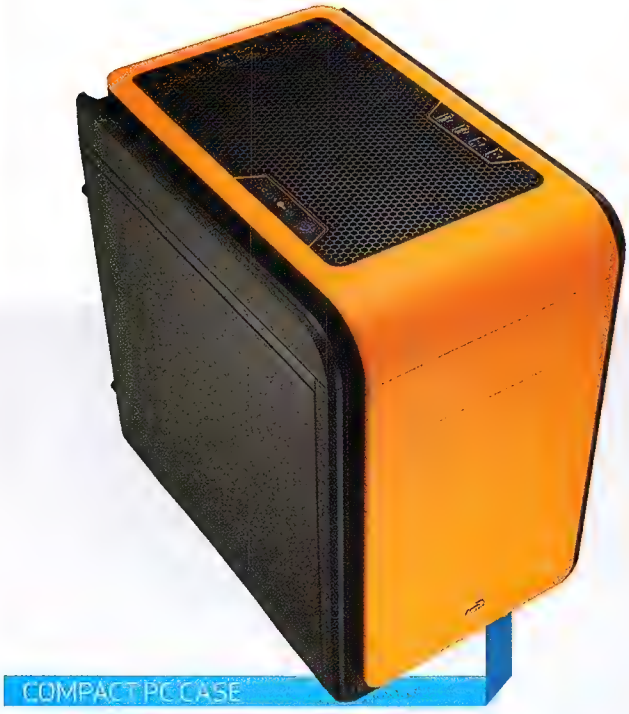
Styles vary, and some cases are actually larger externally than they look, so dimensions are important. While many cases support mATX and mini-ITX, just as many concentrate on mini-ITX only. Depending on your build, CPU cooler height, GPU length and PSU length are the key features. Some cases also only have a single expansion slot, which rules out double width GPUs.

For slimmer cases, there are low-rise CPU heatsinks available or all-in-one water cooling systems. 160mm+ is enough room for most power supplies, but double check, as those with modular cabling can need some extra space. Almost all the mini cases tested have options for water-cooling upgrades, such as room for 120mm or 240mm radiators.

All the cases tested have dual USB 3.0 ports (and most have 3.5mm audio jacks), but the locations vary. For an HTPC, top ports can give a sleeker look, whereas for a desktop or an on-the-floor PC, front or side connections are more convenient. As always, shop around online to find the best price; PC-part search engine **www.staticice.com.au** is a good place to start.

PC CASE SPECIFICATIONS

	AEROCOOL DS CUBE	BITFENIX PRODIGY	COOLER MASTER HAF 915R	CORSAIR GRAPHITE SERIES 380T	CORSAIR OBSIDIAN SERIES 250D	DEEPCOOL STEAM CASTLE SFF	LIAN LI PC-Q07	THERMALTAKE SUPRESSOR F1
PRICE	$125	$103	$79	$159	$129	$105	$99	$75
FORM FACTOR	MATX, MINI ITX	MATX, MINI ITX	MINI ITX	MINI ITX	MINI ITX	MATX, MINI ITX	MINI ITX	MINI ITX
DIMENSIONS	411 X 265 X 381MM	404 X 250 X 359MM	578 X 228 X 248 MM	393 X 292 X 356MM	351 X 277 X 290MM	420 X 278 X 406MM	290 X 208 X 193MM	319 X 260 X 276MM
WEIGHT	5.9 KG	7.0 KG	5.7 KG	5.7 KG	4.4 KG	6.8 KG	1.1 KG	3.2 KG
MAX GPU LENGTH	320MM	310MM	360MM	290MM	290MM	320MM	180MM	255MM
CPU COOLER HEIGHT	200MM	170MM	80 / 170MM	150MM	95MM	200MM	70MM	120 / 140MM
MAX PSU LENGTH	160MM	160MM	200MM	160MM	180MM	160MM	160MM	200MM
HARD DRIVE BAYS	2X 3.5", 3X 2.5"	2X 3.5", 4X 2.5"	2X 3.5", 2X 2.5"	2X 3.5", 2X 2.5"	2X 3.5", 2X 2.5"	3X 3.5", 2X 2.5"	1X 3.5", 1X 2.5"	2X 3.5", 2X 2.5"
OPTICAL DRIVE SUPPORT	YES	YES	YES	NO	YES	YES	YES	NO
PCIE EXPANSION SLOTS	4X	2X	2X	2X	2X	4X	1X	2X
FRONT PORTS	2X USB 3.0, 2X USB 2.0, 3.5MM AUDIO I/O	2X USB 3.0, 3.5MM AUDIO I/O	2X USB 3.0, 3.5MM AUDIO I/O	2X USB 3.0, 3.5MM AUDIO I/O	2X USB 3.0, 3.5MM AUDIO I/O	2X USB 3.0, 3.5MM AUDIO I/O	2X USB 3.0	2X USB 3.0, 3.5MM AUDIO I/O
INCLUDED FANS	200MM / 120MM	2X 120MM	92MM / 120MM	140MM / 120MM	140MM / 120MM	200MM / 120MM	NONE	200MM FRONT
OPTIONAL FANS	2X 120 MM TOP	2X 120MM TOP	120 / 140 MM SIDE	2X 120MM SIDE	2X 120MM, 2X 80MM	2X 120 MM TOP	NONE	2X 80MM REAR
WATER COOLING SUPPORT	240MM	240MM	120MM	240MM	240MM	240MM	NO	120MM
COLOURS	9	6	BLACK	WHITE, BLACK, YELLOW	BLACK	4	SILVER, BLACK	BLACK
EXTRAS	TWO TOP PANELS	OPTIONAL WINDOW PANELS	STACKS	FAN CONTROL	REMOVEABLE REAR PANEL	LED LIGHTING	PASSIVE COOLING	CASE WINDOW



COMPACT PC CASE

$125 | WWW.ANYWARE.COM.AU

Aerocool DS Cube

Supporting both mini-ITX and mATX.

The DS in the Cube's name stands for 'Dead Silence', so it's no surprise that the case has a range of sound-dampening options. It has a slow-spinning 200mm front fan, rubber shock absorbers for the PSU, water-cooling options and drives and a top vent, which can be replaced with a solid panel.

Inside the Cube is a little more normal, with four expansion slots and removable drive bays that allow up to 200mm CPU cooler clearance. You can also squeeze in GPUs up to 320mm long, or 350mm if you remove the front fan. The Cube has a 5.25-inch bay and takes two 2.5-inch drives, a 3.5-inch drive and another two of either size. It takes a standard PSU up to 160mm long, with enough room for some (tight) cable management.

The case itself is built from 0.8mm steel (weighing 5.9kg) and measures in at 265 x 411 x 381mm.

Depending what drive bay cages are removed, the top of the case can handle a 240mm radiator with one or two fans, or a 120mm model. Depending what is installed, though, it can cut down on the CPU cooler's available height.

The power buttons are up top, along with two of both USB 3.0 and 2.0, and 3.5mm audio I/O jacks.

A side window panel is listed as an optional extra, but is sold with most cases in Australia.

The Cube also stands out by being available in nine different colours, from normal black or silver, through to bright red, blue or even champagne.

Verdict

Excellent colour choice and performance, for a slightly higher price.

★★★½☆

COMPACT PC CASE

$103 | WWW.BITFENIX.COM

BitFenix Prodigy

A long-time favourite among the mini-PC crowd.

With a simple yet classic old-school Mac Pro style, the Prodigy is actually built from tough impact-resistant plastic on the outside and steel on the inside.

Along with an impressive array of colours, the Prodigy has various windowed and vented side and front panels available. The case is also available in quite a few different versions, and it's important to differentiate them. The standard (and cheapest) model supports mini-ITX motherboards only. The Prodigy Warrior and Storm (also mini-ITX) models have vented front panels and come in black with red highlights, and white with blue highlights, respectively. The slightly more expensive Prodigy M looks the same and has the same dimensions, but can also squeeze in a mATX board, rather than just mini-ITX.

The Prodigy is a little larger than some small form factor cases, and measures in at 404 x 250 x 359mm and weighs 7kg. The case has a 5.25-inch optical drive bay, a removable cage that takes four 2.5-inch or 3.5-inch drives and space for another two 3.5-inch HDDs. Inside, it has clearance for a 170mm-tall CPU cooler and handles a 160mm-long PSU. With the drive cage in, GPU length is restricted to 170mm, but with it out, a longer 310mm of space is available. It comes with two 120mm fans standard, for decent airflow, but has room for a 240mm water-cooling radiator up top. The power and reset buttons, dual USB 3.0 and 3.5mm audio I/O jacks are mounted to one of the side panels.

Verdict

A versatile and customisable option tough enough to take to a LAN.

★★★★½

COMPACT PC CASE

$79 | WWW.COOLERMASTER.COM

Cooler Master HAF 915R/F

Get your stack on.

Designed to work alongside larger cases, the 915 can be attached top or bottom to build a dual-purpose PC or provide expanded water-cooling or RAID options. It's also a complete standalone case for mini-ITX motherboards.

Unlike boxier but more compact offerings, the 915 is long – measuring in at 578mm deep, but a smaller 228mm wide and 248mm high. The HAF 915 actually comes in two versions – the R and the F. They look identical, but the differences are important. The R has the PSU at the rear, which limits the CPU cooler height to 80mm but gives a bit more room for extra SSDs. The F moves the PSU to the front, which gives 170mm of cooler clearance but fewer drives. Cooling is provided by a 92mm front-mounted fan on the R and a 120mm rear fan on the F, as well as optional 120mm or 140mm fans on the side panels.

Both versions can handle GPUs up to 360mm long and can squeeze in a 120mm liquid CPU cooler. It also can take a 5.25-inch optical drive and has two expansions slots around the back.

The I/O port includes usual USB 3.0, as well as 3.5mm audio.

For those who want to expand on an existing HAF case, the 915 is a great option. It can also hold its own for a standalone build, if you like the long style or need the extra GPU space. Otherwise, the Cooler Master Elite 120 Advanced is an excellent choice.

Verdict

A unique option for more specialised builds.

★★★★☆

COMPACT PC CASE

$159 | WWW.CORSAIR.COM

Corsair Graphite Series 380T

Totally gaming focused.

Taking a PC to a LAN party can be a painful experience, but the 380T makes mobility easier with a built-in carry handle. It's still not small, though, considering it only fits a mini-ITX motherboard and not mATX.

The extra girth is put to good use, with tool-less clip-off side panels that are almost entirely covered in mesh for airflow, and windows to show off the hardware inside. Up the front, it has a 140mm fan, while the back sports a 120mm model – both of which include LEDs, along with another in the case itself. The case has a three-speed controller, as well as room for extra fans or 240mm water-cooling on the side. The 380T takes a normal 160mm PSU and leaves room for a slightly shorter-than-ideal 150mm-high CPU cooler. It has two expansion slots on the rear, and room inside for a 290mm-long videocard. The 380T has dual tool-less 2.5-inch mounts, as well as two more spots to house either 2.5-inch or 3.5-inch HDDs, but no 5.25-inch support. The shape of the 380T means that there isn't as much room inside as you might think, and a bit of care is needed to route cabling in a way that won't disrupt any airflow.

The front (top) panel has the usual power and reset, dual USB 3.0, 3.5mm audio I/O and a fan speed control button. The 380T measures in at 356 x 292 x 393mm and weighs 5.6kg.

Verdict

An excellent (but expensive) case for gamers on the go.

★★★½☆

COMPACT PC CASE

$129 | WWW.CORSAIR.COM

Corsair Obsidian Series 250D

Build a gaming PC that blends into the living room.

Imposing and remarkably angular, the 250D has an appealing combination look somewhere between tough and stylish. It's limited to mini-ITX boards only, but has plenty of room for the rest of your higher-end hardware. Up top, it has a 5.25-inch optical drive bay, with two mounts for 2.5-inch drives and two more 3.5-inch/2.5-inch combo slots. It comes with a 140mm front fan and a 120mm side fan, and room for a front 200mm upgrade, dual 80mm fans in the rear and two more 120mm models on the side. Alternatively, the front can take a 120mm or 140mm water-cooling radiator, while the side can support a 240mm radiator. All the vents include removable dust filters, too.

Inside, there's a somewhat low 95mm of CPU cooler headroom, while the PSU has a better-than-most 180mm to fit into. Quite long and powerful GPUs are just fine, with dual expansion slots and up to 290mm of length. Round the back are eight thumbscrews, which allow access directly to the PSU and drive bays from the rear.

For those who like to eye their PC innards, the top of the case as a window at the back. On the front, the 250D has the usual dual USB 3.0 ports and 3.5mm audio I/O jacks.

If you want to build a mATX PC but love the 250D look (and we do), the Obsidian Series includes the larger 350D case, which costs around the same.

Verdict

A very competent, but somewhat chunky case with a higher than ideal price tag.

COMPACT PC CASE

$92 | WWW.DEEPCOOL.COM

DeepCool Steam Castle SFF

A very unique case.

With a chunky steampunk style, available in black, white, red and yellow, the DeepCool case is not for everyone. But if you want to build a mini-ITX or mATX PC that will stand out from the crowd, it doesn't get much better than the Steam Castle.

Underneath the curvy exterior is a fairly normal case – albeit one with a little more rim than some super slim options. The Steam Castle can support PSUs up to 160mm, has a 200mm CPU cooler height restriction and can handle two GPUs up to 320mm long. You also get four expansion slots, a 5.25-inch bay, two 2.5-inch bays and three 3.5-inch bays, one of which can be swapped to become another 2.5-inch bay. The Steam Castle measures in at 406 x 278 x 420mm, but weighs in at a pretty hefty 6.8kg empty.

For those who like to show off their hardware, the case has a side window and controllable LEDs in the top vents. Airflow is above average, with a 200mm fan up front and a 120mm fan in the rear. The case can also support a 240mm water-cooling radiator in the top panel and has water-cooling grommets in the rear.

The build quality on the Steam Castle is quite good, though the plastic outer on the case would need a bit of extra care if travelling to a LAN party.

When buying the Steam Castle, it's worth noting that there are still a few of the older (and cheaper) versions without USB 3.0 floating about.

Verdict

Steampunk style with plenty of features for a powerful build.

COMPACT PC CASE

$100 | WWW.LIAN-LI.COM

Lian Li PC-Q07

Designed for a quiet media PC rather than a gaming monster.

In contrast to the competition, the Q07 is a rather tall, but not very deep or wide case. The design is meant to maximise heat flow via convection, and minimise or eliminate the use of fans – and, in fact, does not come with any.

Up top, the case has a 5.25-inch optical drive bay, as well as room for a both a 3.5-inch and 2.5-inch drive right down the bottom. Due to the smaller size, it only fits a mini-ITX board, which is mounted to a removable side panel. The Q07 has room for a standard ATX PSU (140mm) on one side, but this restricts the CPU cooler to a low profile 70mm model. There is only a single PCI expansion port around the back, with enough length for a 180mm GPU. The front panel has two USB 3.0 ports, as well as a power and reset button, but no audio I/O connections.

The Lian Li case has a very smooth and simple design, but there are a few niggles. The side panels are held on by an array of small screws, which is a fiddly setup compared to quick-release or thumbscrew options. It's not very customisable either – the 5.25-inch bay can't be removed and there is nowhere to add fans without getting creative.

The Q07 is built from aluminium, available in black or silver, weighs in at a tiny 1.1kg and measures in at 193mm x 208mm x 290mm.

Verdict

A simple style and feature set well suited to an HTPC build.

★★★½☆

COMPACT PC CASE

$75 | WWW.THERMALTAKE.COM

Thermaltake Suppressor F1

A versatile mini-ITX option.

Compared to some of the weird and wonderful designs available, the F1 is fairly close to a cube. The brushed style front panel looks understated enough for use as a traditional media PC and the case is only available in black – inside and out. To make life a little more interesting, the Suppressor does use interchangeable side and top panels (one of which is a window) to show off your high-end build from the perfect angle.

The F1 hides a massive 200mm cooling fan under the front cover, which works to quietly but effectively pump air through the rest of the case. Alternatively, it has room for a 120mm or 140mm water-cooling radiator – but not the larger 240mm options.

To make your high-power PC builds easy, the F1 uses a standard sized PSU up to 200mm long, and has ample room for the inevitable cluster of cables. Dual 2.5-inch and 3.5-inch drives can be squeezed in alongside the motherboard on removable caddies.

On the side of the front is the power and reset, and with dual USB 3.0 ports and 3.5mm audio I/O.

The F1 can handle a pretty decent gaming setup, with GPUs up to 255mm and a single CPU cooler up to 140mm. You can also add twin 80mm fans in the rear if needed and the vents have removable filters. The case has two PCI expansion slots round the back with a screw cover.

The compact little F1 measures in at 276 x 260 x 319mm and weighs 3.2kg when empty.

Verdict

A simple but very effective case for small builds.

★★★★☆

FAST FIXES FOR TECH TROUBLES

THE ULTIMATE TROUBLESHOOTING GUIDES: 20+ PAGES OF ESSENTIAL KNOW-HOW FOR PC, MAC, ANDROID & iOS

TROUBLESHOOT ANYTHING!

SOLVE PROBLEMS WITH ANY DEVICE

COMPLETELY CLEAN A MALWARE-INFECTED SYSTEM

SPEED UP A SLOW PC, SMARTPHONE OR TABLET

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Learn the essentials of troubleshooting and diagnosing common tech problems.

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Our favourite tools for fixing problems, speeding up monotonous tasks and ensuring the basics are covered.

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65 MEND A MEANDERING MAC
Is your Mac running slowly? These tips grease its cogs and shift it up a gear.

66 AID AN ADDLED ANDROID
Don't use your sluggish Android device as an excuse to buy a new one. Take the handbrake off.

67 IMPROVE AN INERT IPHONE OR IPAD
iOS devices aren't immune to slowdown over time. Here are the top tricks to get it running more smoothly.

68 COMPLETELY CLEAN A MALWARE-INFECTED PC
Many PC problems are caused by malware. We explore how you can proceed in a worst-case scenario.

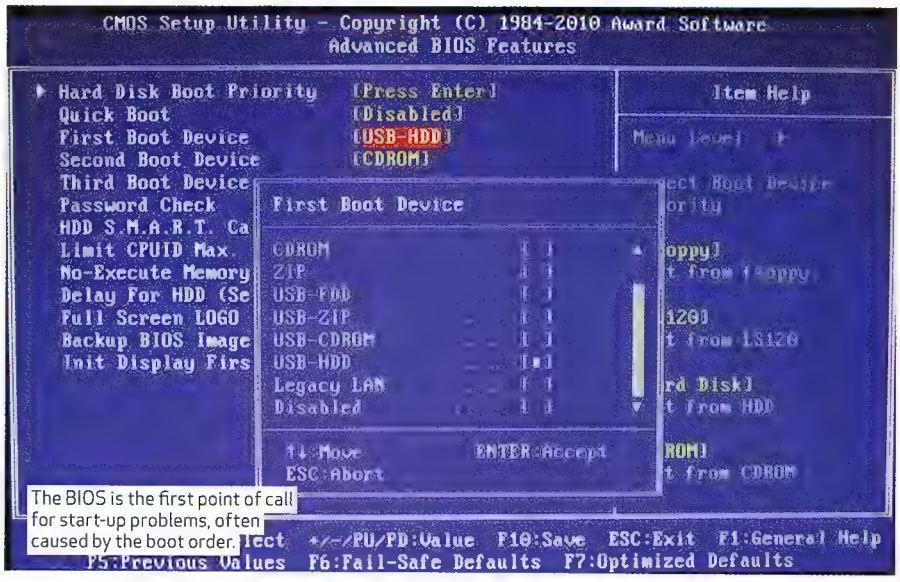
70 RESTORE, REFRESH OR REINSTALL WINDOWS 10
Is your PC behaving strangely or sluggishly? Discover your options for restoring Windows 10 to its best.

Tackle your tech troubles

Learn the essentials of troubleshooting and diagnosing common tech problems with Lindsay Handmer.

From the outside, fixing wayward tech seems like a dark art. To those in the know, it's a fairly logical progression of observing symptoms, checking potential fault causes, frantic googling and the odd sacrifice along the way. Rather than give a list of specific problems and how to fix them, we have covered common faults types and potential ways to narrow down the cause and attempt a fix.

We have focused on the glitchiest technology, such as computers, smartphone, tablets and modems/routers. But the same advice applies to other electronic goods, from washing machines to car stereos. Remember, **never** mess with 240v mains power. It's also worth saying to back up your devices now, before any issues arise, as you may not get a chance later.



The BIOS is the first point of call for start-up problems, often caused by the boot order.

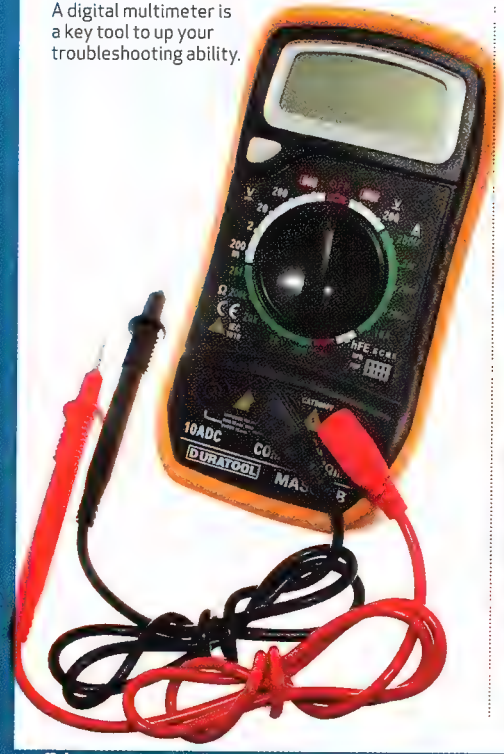
STARTING TROUBLESHOOTING

Keep a look out for potential problems and try to establish what causes them, or any recent changes. Do a visual inspection – tiny cracks in smartphone screens can cause touch issues, while worn cables could indicate internal problems. For intermittent errors, keep a written log instead of relying on memory. Having as much information as possible is critical to solving any problems.

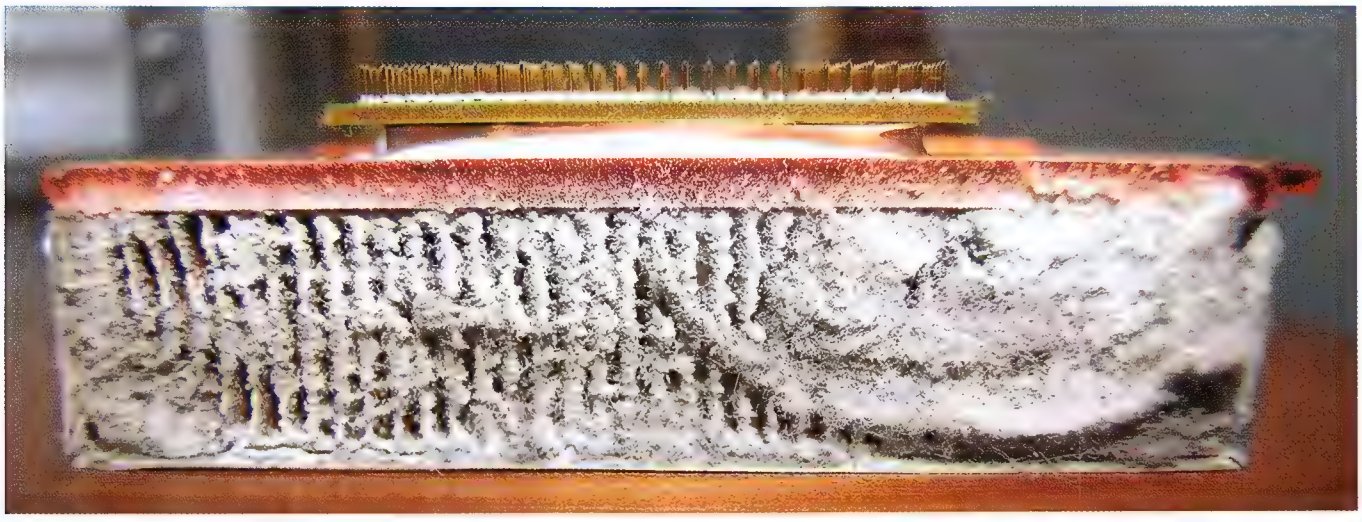
Often, it's simply a process of elimination to narrow down where the fault originates. For example, if a keyboard appears faulty, first try it in another computer, or test a known good keyboard on the computer. When checking for fixes to problems, try to change only one thing at a time, so if the problem goes away, the cause is known. For problems such as software not running, use tools such as Windows compatibility mode.

Research is key – the majority of tech troubles faced have already been experienced by countless others, and often solved. Even better, the info is usually found relatively easily online. The trick is knowing what to search for on Google. Use details such as model numbers, operating system versions and app names, as well as a simplified description of the problem, to narrow it down. Only follow online advice if you understand the implications, though, as it is possible to create further problems. For some of our advice, we suggest actions such as logging into the BIOS. Rather than an exhaustive list on how to do this on every different machine, we leave it up to you to check online.

For most troubleshooting, only very basic tools (or none at all) are needed, such as screwdrivers. For more indepth


A digital multimeter is a key tool to up your troubleshooting ability.

Wi-Fi Analyzer is a very useful tool for troubleshooting wireless network connectivity problems.



diagnoses, a multimeter is extremely useful. For example, it can be used to test whether the correct voltage (or any at all) is being provided by a cable or charger.

HAVE YOU TRIED TURNING IT ON AND OFF AGAIN?

It's clichéd but oh so accurate – in our experience simply turning your tech on and off again tends to solve about 50% of problems. This works for just about everything, from laptops to modems, routers to smartphones and tablets. It sounds simple, but is an important first step of troubleshooting – checking that the problem is ongoing. For the best reset, fully unplug devices, remove any batteries (if possible) and try to turn them on to make sure no residual power is left. For many devices, holding down the power button will force it to turn off. If the problem recurs, try to note any potential causes before moving on with more indepth trouble shooting.

It's also worth unplugging and plugging back in any connections, such as USB devices and power cords, even if they look well seated. If in doubt, test any peripherals on another PC. Sometimes due to slight difference in plug shapes, cables (such as HDMI) can work on one device but not another.

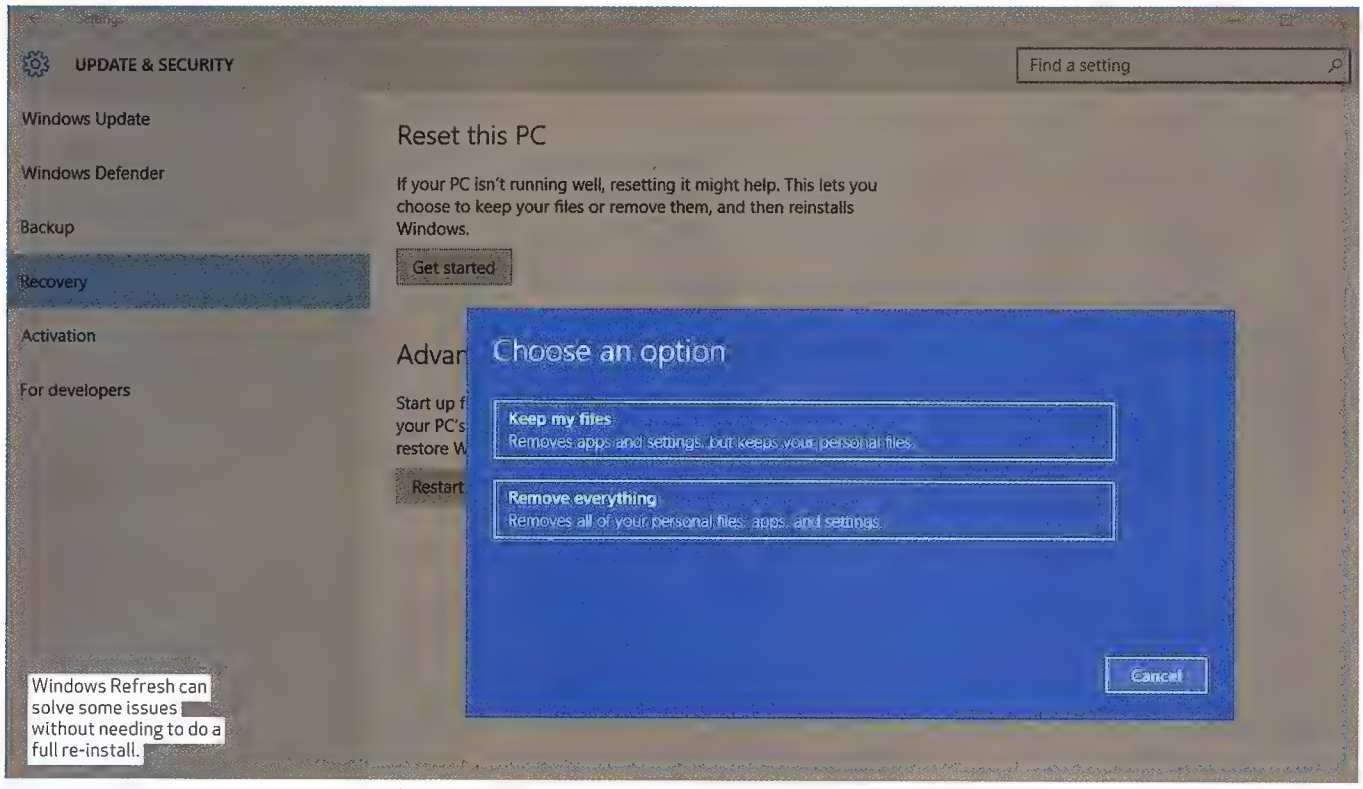
CRASHES, RESTARTS AND BOOT ISSUES

Some of the most frustrating tech issues to troubleshoot are inexplicable freezes, resets and boot halts, where the root cause is hard to track down.

A common cause is an automatic background driver or software update that then causes a stability problem. For example, we have experienced intermittent crashes from a new version of Chrome and the latest Nvidia drivers. Check the update history and if there is a new version, roll it back to the previous one. Disable automatic updates to stop it happening again. In some cases, it's necessary to

Clogged fans and vents causes overheating, which can result in freezing and slow performance.

When troubleshooting, re-seat hardware such as RAM to eliminate poor connections as a potential source of an issue.


UPDATE & SECURITY
Find a setting
Windows Update
Windows Defender
Backup
Recovery
Activation
For developers
Reset this PC
If your PC isn't running well, resetting it might help. This lets you choose to keep your files or remove them, and then reinstalls Windows.
Get started
Choose an option
Keep my files
Removes apps and settings, but keeps your personal files.
Remove everything
Removes all of your personal files, apps, and settings.
Cancel
Windows Refresh can solve some issues without needing to do a full re-install.

wait until there is a newer version and manually update to that.

In Windows, restore points can be an easy way to take a system back to a time it worked correctly. Sometimes, it is necessary to boot into safe mode in Windows to be able to fix driver issues. Holding down F8 doesn't work on newer machines – instead the best bet is to create a USB recovery drive. From Windows, holding shift and clicking reset boots back into safe mode. Otherwise, the OS will ask if you need help after a number of failed boots.

If a computer refuses to boot all the way to the OS, there are a few common reasons. First, unplug everything but the power and a keyboard and try again. It seems counterintuitive, but a range of USB devices can cause BIOS to halt a boot. Another common issue is a PC trying to boot from a USB stick – in which case, the BIOS needs to be set to boot from the main drive first. Log in to BIOS and check that the system is recognising hard drives and, of course, don't forget to check any cables.

RESTORE TO DEFAULT

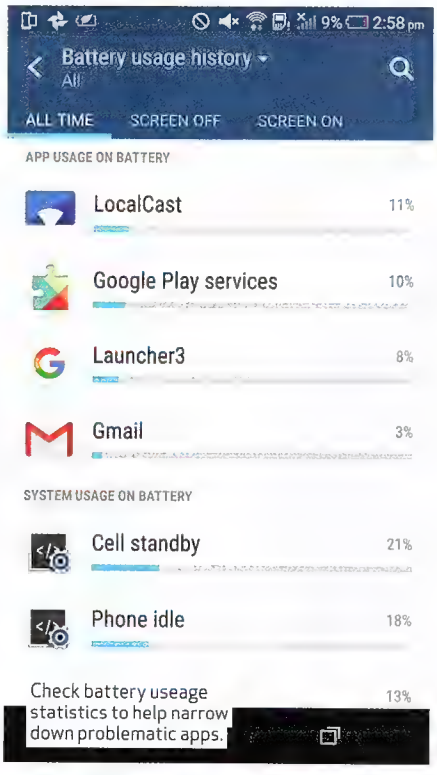
Trying to fix a hard-to-find software glitch can be very time consuming and, often, it's better to cut your losses and simply start from scratch. For a computer, a full format and reinstall is often best, and can be surprisingly fast. Ideally, you want to save a system image and simply restore from that. Otherwise, the built-in Windows refresh option does a decent job. You can do a full wipe, or a lesser spruce up that keeps all your files and programs intact.

For other devices, such as those using iOS or Android, in the settings menu are options to do a factory reset. This can often be the only way to fix issues caused by errant apps, even after they are uninstalled.

Of course, don't forget to fully back up your files and app data before performing a reset.

COOL IT!

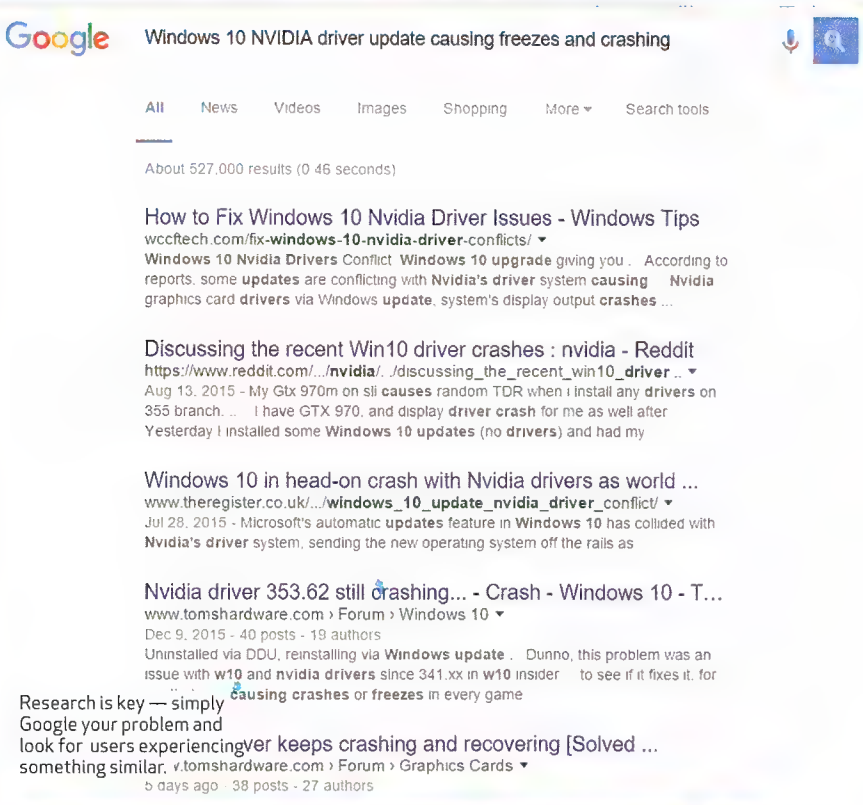
Overheating can cause all sorts of issues that are hard to troubleshoot in a range of devices. Common symptoms are freezes, random resets, sluggish performance and louder-than-normal fans. The first step towards a diagnosis is a visual inspection of fans and vents. A sign of heat problems is a device that works fine at first or after being allowed to cool. Even if all looks clear, preventative cleaning is always a good idea.



Often affected are modems, routers and media players that don't have enough airflow. These tend to rely on passive cooling, so need a fairly open spot with nothing stacked on top.

Laptops and desktop computers can also suffer from clogged airways and, in an effort to keep cool, the system will often reduce performance. Cleaning out fans and vents is relatively easy – remove the computer's covers and vacuum (with power setting down to low) away any build-up. Getting access to a laptop's fans is often tricker (depending on the model), but there are excellent guides to disassembly on websites such as **iFixit.com**. A can of compressed air can help remove dust in hard-to-reach locations. Less commonly, overheating issues can be caused by old or incorrectly installed heatsink paste. Care needs to be taken, but following the guide for your model, new paste is relatively easy to do.

For sealed devices such as phones and tablets, overheating is likely from a software issue, such as an app stressing the CPU. Look for major battery drains, keep it uncovered when charging and test it without a case. Also research your model online, as there are some that suffer from chronic overheating.


Google
Windows 10 NVIDIA driver update causing freezes and crashing
All
News
Videos
Images
Shopping
More
Search tools
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How to Fix Windows 10 Nvidia Driver Issues - Windows Tips
wccftech.com/fix-windows-10-nvidia-driver-conflicts/
Windows 10 Nvidia Drivers Conflict Windows 10 upgrade giving you . According to reports, some updates are conflicting with Nvidia's driver system causing Nvidia graphics card drivers via Windows update, system's display output crashes ...
Discussing the recent Win10 driver crashes : nvidia - Reddit
https://www.reddit.com/.../nvidia/. ./discussing_the_recent_win10_driver ..
Aug 13, 2015 - My Gtx 970m on sli causes random TDR when i install any drivers on 355 branch. .. I have GTX 970, and display driver crash for me as well after Yesterday I installed some Windows 10 updates (no drivers) and had my
Windows 10 in head-on crash with Nvidia drivers as world ...
www.theregister.co.uk/.../windows_10_update_nvidia_driver_conflict/
Jul 28, 2015 - Microsoft's automatic updates feature in Windows 10 has collided with Nvidia's driver system, sending the new operating system off the rails as
Nvidia driver 353.62 still crashing... - Crash - Windows 10 - T...
www.tomshardware.com › Forum › Windows 10
Dec 9, 2015 - 40 posts - 19 authors
Uninstalled via DDU, reinstalling via Windows update . Dunno, this problem was an issue with w10 and nvidia drivers since 341.xx in w10 insider to see if it fixes it, for causing crashes or freezes in every game
Research is key — simply Google your problem and look for users experiencing something similar.
ver keeps crashing and recovering [Solved ...
v.tomshardware.com › Forum › Graphics Cards
5 days ago 38 posts - 27 authors

"If a computer refuses to boot all the way to the OS, there are a few common reasons. First, unplug everything but the power and a keyboard and try again. It seems counterintuitive, but a range of USB devices can cause BIOS to halt a boot."

RE-SEATING HARDWARE

Hard to track down problems with freezing, restarts and incomplete boots are sometimes caused by bad hardware connections. Every time a computer turns on and off, it heats up and cools down, which causes tiny movements between components. Over time, these can cause intermittent faults that are frustrating, but easy to fix.

The most common problems are RAM-related, as well as CPUs and GPUs, or to a lesser extent, power and other connections. To reseat hardware, simply remove it completely, remove any dust (compressed air is ideal) and then make sure it is fully and firmly plugged back in. Even if it does not fix the problem, you have eliminated one more possible cause.

BATTERIES

Short or inconsistent battery life can have many causes. When troubleshooting, consider the age and usage patterns first — batteries lose capacity over time and have limited number of charge cycles available. Being left in a hot environment (such as a car) can also negatively affect batteries.

For a sudden loss of battery life (especially on laptops or phones), the culprit is usually software related. Apps can keep smartphone CPUs or services such as GPS in use, quickly draining a battery. OS and other software updates can also change hardware use that can impact battery life. On many operating systems, such as Android, iOS and Windows 10, it's possible to look at battery use stats and see what apps, hardware or services are to blame.

Another factor is charging problems. For many devices, low-quality chargers may not supply enough current to charge, or only do so very slowly. Cheap cables (especially micro-USB ones) can develop internal breaks which can cause intermittent charging. Many new laptops (such as Dell models) receive a signal from the charger to determine the capacity, and that they are genuine. Off-brand replacements, or DC plug connections problems can cause a laptop to simply refuse to charge.

Battery charging faces a few myths, too. It's not an issue to leave a device plugged in at 100% charge. There is no need to do a full discharge — charging as soon as possible prolongs the life. Batteries do self-discharge slowly over time, and if left uncharged for too long, they can be damaged and be unable to be recharged.

NETWORK ISSUES

Poor Wi-Fi and Internet connections can be the bane of existence, but are often easy to troubleshoot and fix. One of the most common issues is interference, which can cause dropouts, slow speeds and weak reception. Wi-Fi shares overlapping channels, so other 2.4GHz devices — such as baby monitors, portable phones, wireless video, RC toys and even other routers — can create problems. Phone apps such as Wi-Fi Analyzer (**www.farproc.com**) help analyse the signal in your area and suggest a new channel. Other interference can be caused by computers and microwaves — in which case, switching to a 5GHz Wi-Fi network can help.

For modems, one of the most common causes of slow speeds and Internet disconnections is oxidisation on cable and sockets. The ideal solution is to replace your modem telephone cable, and the wall socket plug.

IDENTIFY THE BOTTLENECK

Troubleshooting performance issues can be tricky, with a lot of different factors. For mobile devices such as smartphones, most slowdowns occur from new apps or OS updates. Beyond uninstalling apps or factory reset, there are not many ways to improve the situation.

For desktop PCs — and to a lesser extent laptops — performance issues are often due to bloatware. Remove offending apps, such as Norton or McAfee, and scan for malware with free software such as Malwarebytes Anti Malware (**www.malwarebytes.org**).

For older machines, hardware can cause performance bottlenecks. If your PC is very slow to boot and takes a long time to load new programs, then an SSD upgrade is worth considering. If it performs poorly when running a lot of apps at once, or with a lot of browser windows open, then extra RAM could help. CPUs are generally not a bottleneck (at least not one worth upgrading), while slower GPUs are only really a problem for gamers. ■

APC's essential utility apps

Lindsay Handmer lists APC's favourite tools for fixing problems, speeding up monotonous tasks and ensuring the basics are covered.

To go with this month's troubleshooting theme, we've also put together a list of our favourite utility apps – tools useful for everything from setting up a new computer, to just getting the most out of your existing system. This feature is not just for Windows users either – we've included options for Mac OS X, Android and iOS users too. We've ensured the majority of these apps are free, except in a few special cases where the cost is well worth it. While we've listed apps by OS, many of them are available across multiple platforms, or have alternatives for the same use.

Windows apps

NINITE

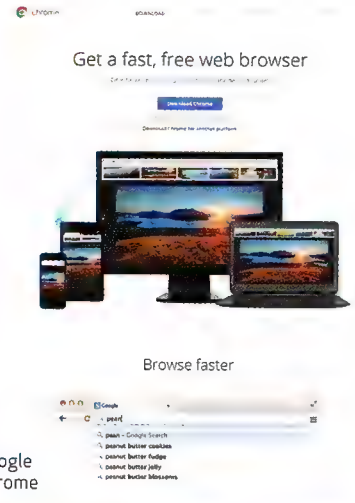
FREE | WWW.NINITE.COM

A very handy installer that can download and automatically install a selection of critical apps. Ninite avoids any toolbars or extras, and runs with no user input. It's great solution for getting a new system up to speed. It can also be used to update existing apps. Ninite Pro can be used on multiple PCs on a network at the same time.

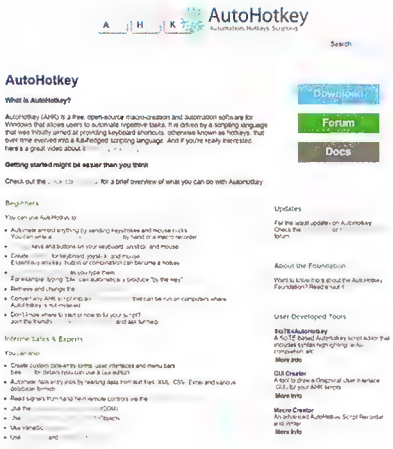
GOOGLE CHROME

FREE | WWW.GOOGLE.COM/CHROME

The new Windows 10 browser Edge is a big improvement on Internet Explorer, but other free options have advantages. Google Chrome is fast on a powerful PC, has great features and extensions, but is a bit of a memory hog. Firefox (**www.mozilla.org**) is slimmer and well supported. Opera (**www.opera.com**) is fast and easy to use.



Google Chrome



AutoHotkey

AUTOHOTKEY

FREE | WWW.AUTOHOTKEY.COM

This free (and open source) software goes beyond just allowing the creation of custom keyboard shortcuts. It can remake keys and buttons, expand typing abbreviations and create hotkeys on other input devices. To automate repetitive tasks, AutoHotKey can create complex inputted or recorded macros. Scripts can be exported as an .exe to run on other systems.

PAINT.NET

FREE | WWW.GETPAINT.NET

An excellent free image editor – Paint.NET has many features shared by higher-end paid software. It can handle essentials like layers and effects, and is easy to learn and use. Importantly, it's continually updated, with new features and better support. It can also run on low-end hardware, such as Atom and Celeron CPUs.

OPENOFFICE

FREE | WWW.OPENOFFICE.ORG

Productivity apps such as Word are critical to getting work done, but are often expensive and very large to install. OpenOffice is small, totally free and includes a word processor, spreadsheets, presentation creation, drawing, database manipulation and a maths program. OpenOffice can also read existing .doc and .docx files, or save in the format. It also has a large selection of language packages.

Foxit Reader

UBLOCK ORIGIN

FREE | WWW.GITHUB.COM/GORHILL/UBLOCK

The Internet is a much nicer place with an Adblocker, which can also give protection against Malware. Not all ad blockers are available for every browser, though. One of the most popular and widely available is Adblock Plus (**www.adblockplus.org**) but it is criticised for participating in the acceptable advertising program. uBlock Origin (**www.github.com/gorhill/uBlock**) is a popular pure ad blocker for Chrome and Firefox.

FOXIT READER

FREE | WWW.FOXITSOFTWARE.COM

The free Adobe Acrobat reader is decent, but other free options offer better features. Foxit Reader lets you view, create, annotate and print PDFs. Sumatra (**www.sumatrapdfreader.rog**) is a simple free PDF reader that can also open eBooks. PDFCreator (**www.pdfforge.org**) is a powerful and flexible PDF creation tool that can also convert any printable file format to PDF.

MALWAREBYTES ANTI MALWARE

FREE | WWW.MALWAREBYTES.ORG

For many, the excellent built-in Windows Defender (**www.microsoft.com**) is probably enough protection. For extra peace of mind, Malwarebytes Anti Malware is a popular choice.

Malwarebytes Anti Malware

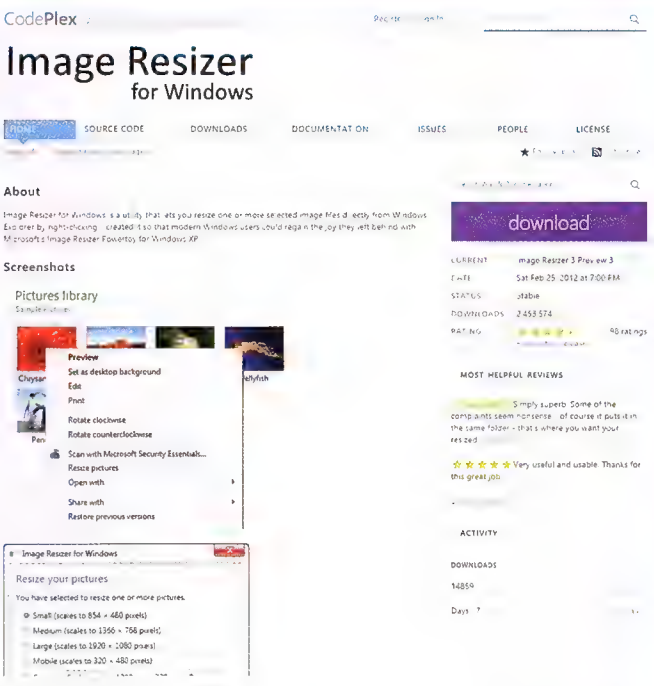


Image Resizer

It's free, and can help thwart nasties and remove malware. It's also compatible with other free antivirus programs, such as Avast (**www.avast.com**) and AVG (**www.avg.com**). A premium version with extras such as real-time protection and malicious website blocking is available.

QBITTORENT

FREE | WWW.QBITTORENT.COM

Potentially illegitimate uses aside, torrents can be a great way to handle high-speed downloads of programs and files. When the favourite, uTorrent, went a bit rouge, qBittorent stepped up, with an excellent interface and useful features such as an integrated search engine, web remote, IP filtering and bandwidth scheduler. It's also available on various platforms, such as Linux and Mac OS.

CCLEANER

FREE | WWW.PIRIFORM.COM

CCleaner has two main uses. To ensure total privacy after using a PC, running the program does a full sweep and clean of browser history, cookies, Internet files and passwords. It can also be used to help a slow PC, by removing temporary files, cleaning up the registry and disabling unnecessary programs from starting up at boot.

WINDIRSTAT

FREE | WWW.WINDIRSTAT.INFO

With limited space on SSDs, wrangling unneeded space hog files is an ongoing process. WinDirStat makes it easy to see what is using up your previous gigabytes with graphical tree map display based on size. You can then check and delete the offending files and free up space. It also works on external drives, or network-connected storage.

7-ZIP

FREE | WWW.7-ZIP.ORG

While Windows has some built-in ZIP handling options, it can't handle some of the more exotic formats. If size is critical, 7-ZIP actually does a better job than some of its popular competitors, such as WinRAR (**www.rarlab.com**). It can also perform up to 70% better than a standard zip when using its own format, 7z.

IMAGE RESIZER

FREE | WWW.IMAGERESIZER.CODEPLEX.COM

Back in Windows XP, images could be simply resized without needing extra editing software. Image Resizer brings the same functionality to newer Windows versions. Added as a right-click menu option, you can resize one or more images in just a few clicks. A range of resolutions are available, as well as a custom sizes.

VERACRYPT

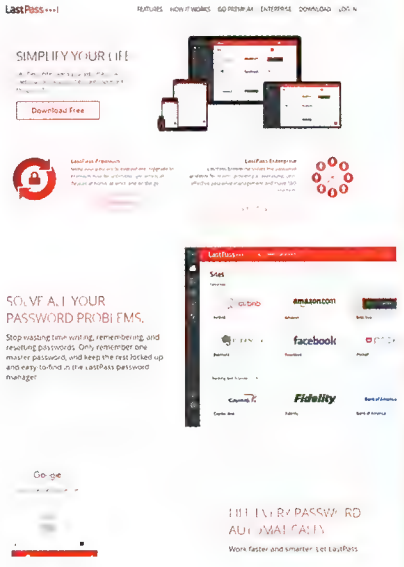
FREE | WWW.VERACRYPT.CODEPLEX.COM

When favourite TrueCrypt was discontinued, VeraCrypt continued on as an open source and free file encryption utility. It supports AES, Serpent and Twofish ciphers. For some Windows users, the built-in BitLocker software offers encryption, but it has also come under fire for being closed-source and having potential backdoors in its security.

LASTPASS

FREE (FOR SINGLE DEVICE)
WWW.LASTPASS.COM

Passwords are easy to forget, which can lead to some pretty insecure



LastPass

practices. A password vault allows you to store complex hard-to-crack passwords in one spot, and secure them with a single hard-to-break but easy to remember password. LastPass can also autofill passwords, and is available across your devices, such as PC, tablet and smartphone.

TEAMVIEWER

FREE | WWW.TEAMVIEWER.COM

Being able to remotely control your home (or work) PC and access files and programs on the go is extremely useful. It's also an easy way to remotely help friends and family with computer issues or hold online meetings. TeamViewer is free for private use, and can be used on other devices, such as smartphones and tablets.

Mac OS X apps

MACAPPS

FREE | WWW.MACAPPS.LINK

The easiest way to automatically install a range of useful apps onto your Mac. Categories include browsers, productivity options, developer programs, tools, utilities, multimedia apps and ways to stay in contact. It includes both free and paid apps, which need a separate licence. MacApps also has a short explanation of what the different apps do.

F.LUX

FREE | WWW.JUSTGETFLUX.COM

Computer screens are typically meant to look a lot like the colour spectrum from the sun. While that's fine during the day, it can disrupt sleep patterns when used at night. F.lux automatically (and slowly) adjusts your monitor to look warmer (and less blue) at night. This science behind the app is researched backed too.

PARALLELS DESKTOP

FREE | WWW.PARALLELS.COM

Sometimes, it is useful to run Windows applications on a Mac, especially games. It's possible to use Boot Camp to install Windows, but a virtual machine can be used to run software within Mac OS instead. Parallels costs $100, but is fast and well supported. VirtualBox (**www.virtualbox.org**) is slower, but does the same job for free.

DUET DISPLAY

$24.99 | WWW.DUETDISPLAY.COM

A second screen for your laptop is super handy, but impractical to carry around. Duet turns an existing iPad into a display instead and works on Mac and Windows machines. It connects via your lightning (or 30-pin) cable, and can deliver 60fps with no lag. Even better, the iPad touchscreen can be used to interact with and control your laptop.

HANDBRAKE

FREE | WWW.HANDBRAKE.FR

Have a media file that can't be played on your playback device of choice, such as an Apple TV? HandBrake is a free and open source video transcoder that can handle just about any format out there. It's also useful for reducing the quality, resolution and file size of videos to suit specific devices or storage space restrictions.

iOS apps

GOOGLE TRANSLATE

FREE | WWW.SUPPORT.GOOGLE.COM/TRANSLATE

As close to a Star Trek universal translator as has been made, this app can translate 90 languages through typing. Using a camera, it can instantly translate text (in 26 languages) on items such as signs or menus. It can also do two-way automatic speech translation and has downloadable language packs.

SWIFTKEY

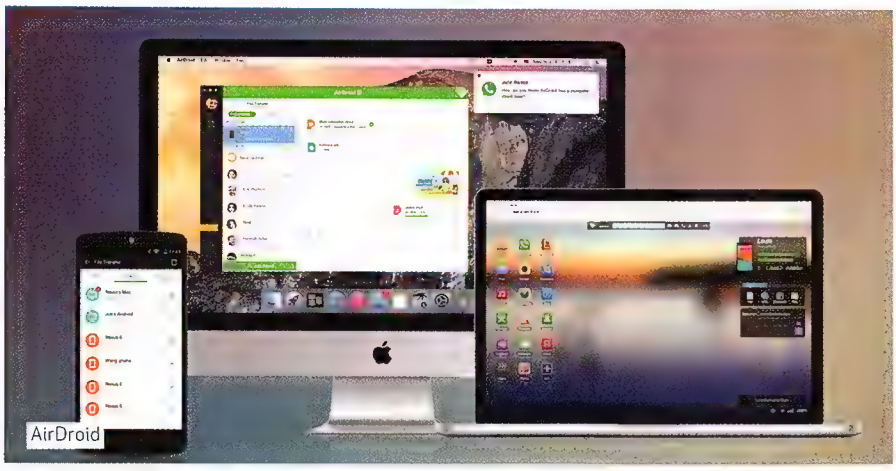
FREE | WWW.SWIFTKEY.COM

A smart keyboard that allows faster smartphone typing with fewer mistakes. The app actually learns your writing style (and reads old texts to judge commonly used words), picks up slang and constantly improves its predictions. With Flow enabled, you can type simply by swiping a finger across the keyboard. SwiftKey also supports over 100 languages.

SIMPLENOTE

FREE | WWW.SIMPLENOTE.COM

Quickly and simply save your thoughts when on the go and have them automatically shared across to all your devices, including a laptop. Simplenote allows tagging and searching to help make finding a specific note easy. Notes are saved each time they are



changed and the revisions can be viewed. The app can also be used to share notes with others.

ADOBE PHOTOSHOP FIX

FREE | WWW.ADOBE.COM

This free iOS-exclusive app is an intuitive yet powerful way to retouch and edit pictures on iPhone or iPad. It uses Photoshop technology you're familiar with, and has tools such as heal, liquefy, smooth and a range of painting and colour options. Coupled to Adobe Creative Cloud (paid), you can sync images with other devices and export .PSD files.

DRAGON DICTATION

FREE | WWW.NUANCE.COM

Powered by Dragon NaturallySpeaking technology, this app is one of the best ways to convert spoken word to text. It's available in multiple languages, too. Aside from notes, you can write emails, send tweets and even post Facebook status updates without typing. Corrections are done with voice as well, giving a very hands off experience.

Android apps

AIRDROID

FREE | WWW.AIRDROID.COM

The ultimate tool to connect your PC and smartphone. Get call, SMS and app notifications on your computer and quickly reply straight from the desktop. You can also easily transfer files between devices and control music. AirDroid can also remotely manage your phone, locate it if lost, mirror some apps on PC and even view footage via the camera.

TINY FLASHLIGHT

FREE | WWW.TINYFLASHLIGHT.COM

A torch is always very useful, but often not on hand when you need it. Tiny Flashlight uses a smartphone's LED flash to create a very bright light. The app has a widget button that can be placed on the home screen, with a few different styles. There are also plugins available, such as a strobe mode or shake on lock screen activation.

LOCALCAST

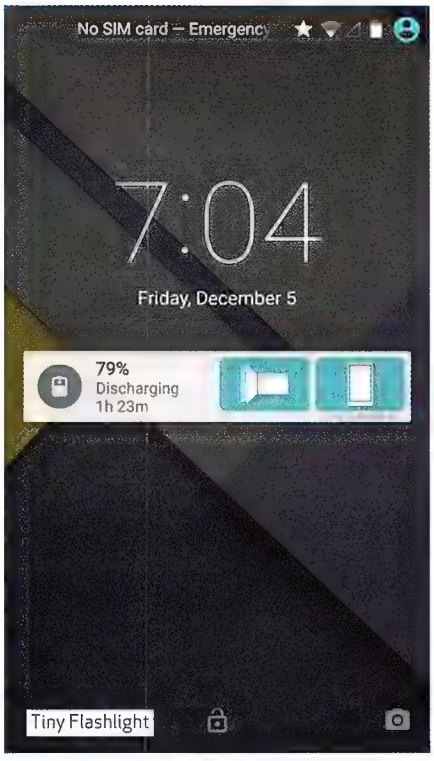
FREE | WWW.LOCALCAST-APP.COM

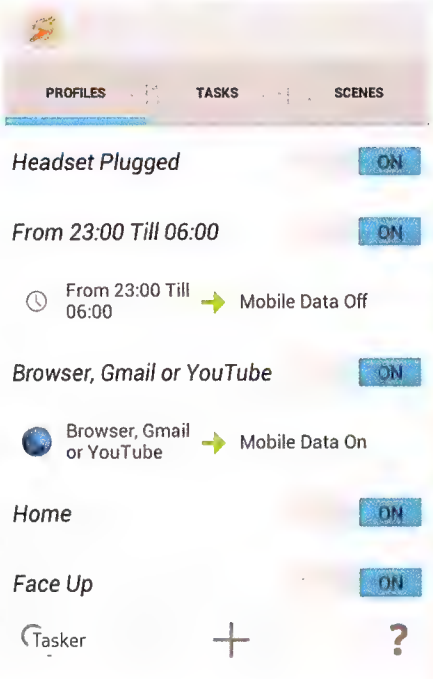
Makes playing a huge variety of content on your Chromecast (or other supporting player or smart TV) easy. It's not just local files either – the app can access a NAS, shared drive or even cloud storage. It can handle subtitles, as well as music streaming and picture slideshows through on-screen touch controls.

TASKER

$3.49 | WWW.TASKER.DINGLISCH.NET

This powerful app allows you to automate tasks when certain events occur. For example, Wi-Fi could be turned off when not at home to save battery. Tasker could be used to automatically turn your phone to silent at night, or at a location such as work. Condi (**www.cond.im**) is a simpler, but free alternative.





ES FILE EXPLORER

FREE | WWW.ESTRONGS.COM

A simple yet powerful way to access, copy and move files in Android. The app also connects to (most) Cloud storage accounts, and can be used to manage content remotely from a computer. ES File Explorer has built-in search functionality, handles ZIP and RAR files and be used to backup files online, or save app data. ■

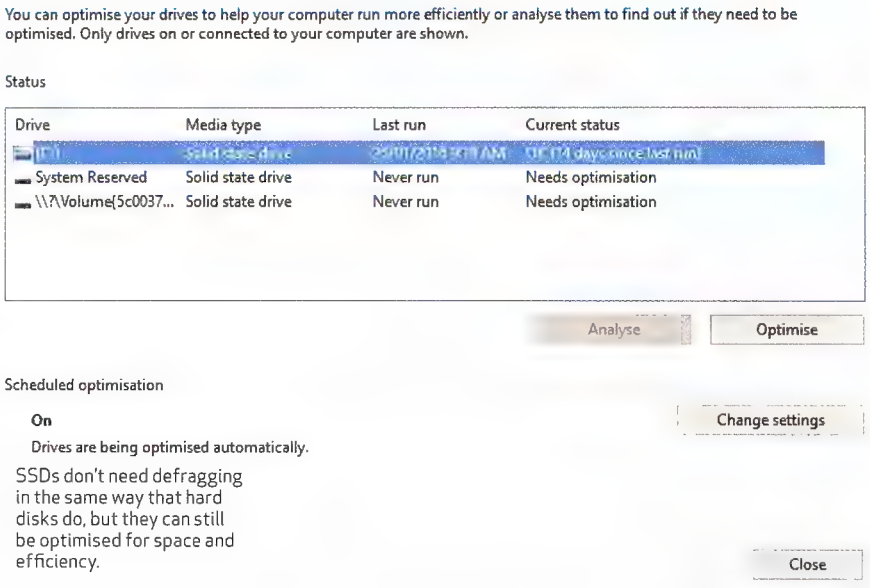
Speed up a sluggish Windows PC

Most PCs inevitably slow down over time. Nathan Taylor reveals how to deal with this common problem on Windows.

So your computer is really chugging. It happens to everyone: as a computer gets older, it gets loaded with more and more crud, while, at the same time, programs start demanding more and more from it.

The easy fix to this problem is obviously "upgrade your PC". On a desktop PC, it's relatively easy to upgrade the memory (low memory is one of the biggest culprits in a slow PC) and the graphics card (which is the biggest determinant of 3D games performance). Another easy upgrade from a hardware perspective is to add an SSD. These make much better system drives than hard disks (you can keep your original hard disk as extra storage). Unfortunately, you then have to go through the laborious process of reinstalling Windows on the SSD, and may have to fiddle with the BIOS/EFI settings to get it to boot properly.

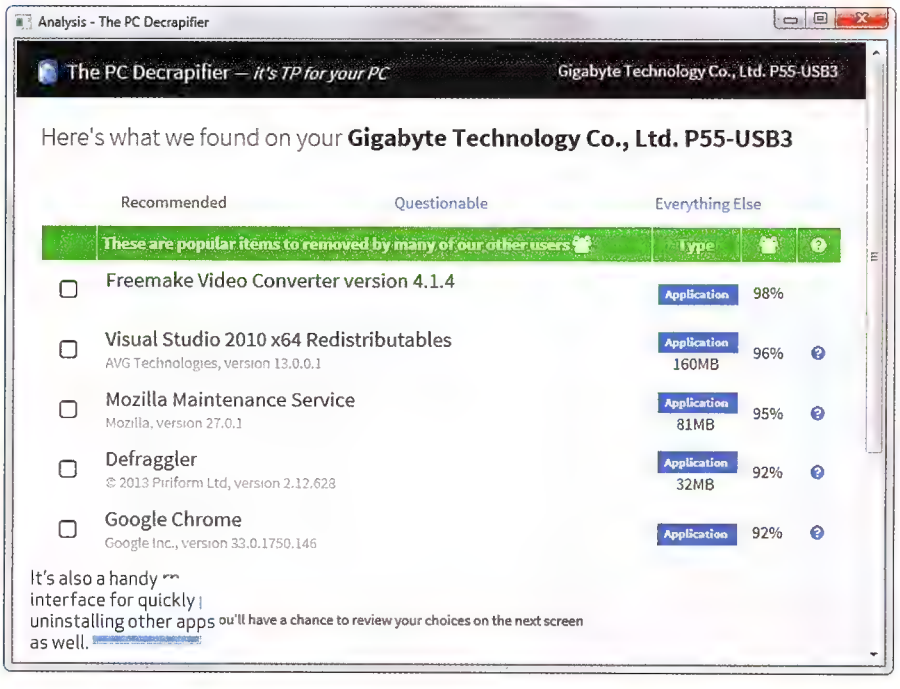
For many people, a hardware upgrade is not an option. So instead, you can try follow these seven steps to get your baby back in fighting form.


You can optimise your drives to help your computer run more efficiently or analyse them to find out if they need to be optimised. Only drives on or connected to your computer are shown.
Status
Drive
Media type
Last run
Current status
System Reserved
Solid state drive
Never run
Needs optimisation
\\?\Volume{5c0037...
Solid state drive
Never run
Needs optimisation
Analyse
Optimise
Scheduled optimisation
On
Drives are being optimised automatically.
Change settings
SSDs don't need defragging in the same way that hard disks do, but they can still be optimised for space and efficiency.
Close

DIAGNOSE THE CAUSE

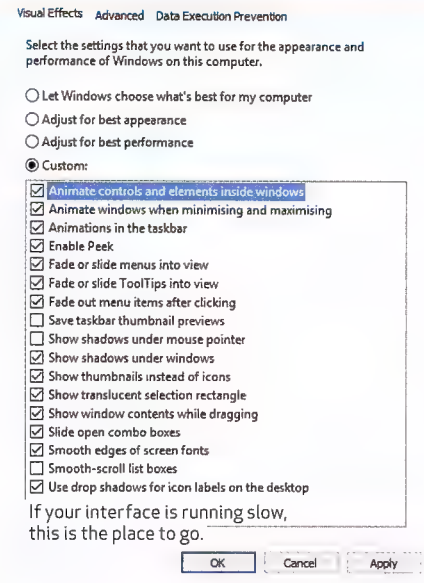
The first thing to do before any remediation is to try to figure out what the hell is taking up your system resources. That's where Task Manager comes in. Right click on an unused part of your task bar and select Task Manager. In Windows 8 and 10, it's much better than it was previously, and gives a very full accounting of what is taking up resources. In the 'Processes' tab, click on 'CPU' to sort them by CPU usage. Is there anything there that's sucking up excess CPU? Then click on 'Memory' and look for things that are taking up large amounts of your system memory. System and compressed memory is part of the OS, so you don't have to worry about that.

If it's a browser that's sucking up huge chunks of memory and CPU time, then you've probably got too many tabs open (we should note that Chrome spawns each tab as a separate process, so there may be dozens of processes for it) – see point 5 below. To kill a process, right click on it and select 'End task'. If that speeds up your system, then you've found your culprit and should work to uninstall the app.

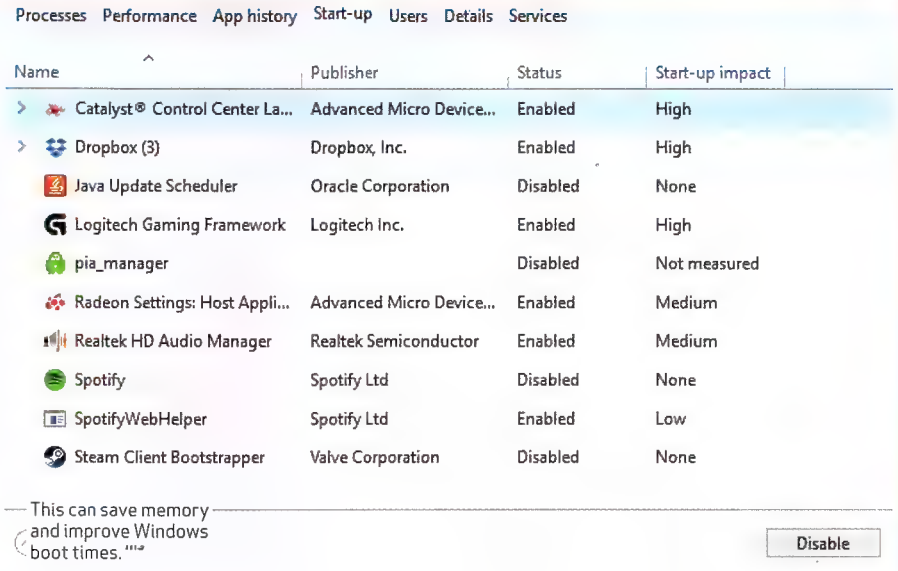


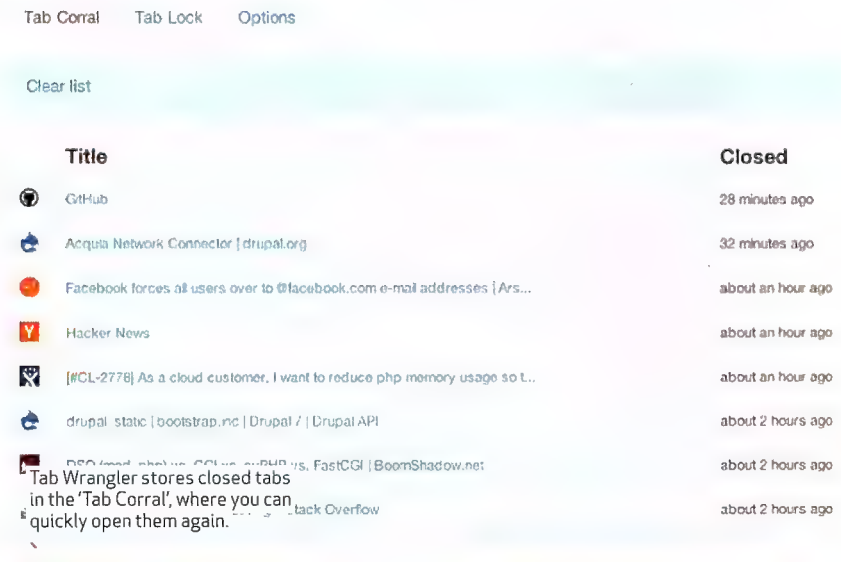
RUN A MALWARE SCAN FROM SAFE MODE

Some of the things that might be slowing down your PC are apps that you don't even know are running. Malware and other junk might be gumming up your CPU and memory. We have a whole section on that a little later (see page 68), so we won't go over it here, but it's absolutely worth jumping into safe mode and running a proper anti-malware scan.


Visual Effects
Advanced
Data Execution Prevention
Select the settings that you want to use for the appearance and performance of Windows on this computer.
Let Windows choose what's best for my computer
Adjust for best appearance
Adjust for best performance
Custom:
Animate controls and elements inside windows
Animate windows when minimising and maximising
Animations in the taskbar
Enable Peek
Fade or slide menus into view
Fade or slide ToolTips into view
Fade out menu items after clicking
Save taskbar thumbnail previews
Show shadows under mouse pointer
Show shadows under windows
Show thumbnails instead of icons
Show translucent selection rectangle
Show window contents while dragging
Slide open combo boxes
Smooth edges of screen fonts
Smooth-scroll list boxes
Use drop shadows for icon labels on the desktop
OK
Cancel
Apply

If your interface is running slow, this is the place to go.




Tab Corral
Tab Lock
Options
Clear list
Title
Closed
GitHub
28 minutes ago
Acquia Network Connector | drupal.org
32 minutes ago
Facebook forces all users over to @facebook.com e-mail addresses | Ars...
about an hour ago
Hacker News
about an hour ago
[#CL-2778] As a cloud customer, I want to reduce php memory usage so t...
about an hour ago
drupal_static | bootstrap.inc | Drupal 7 | Drupal API
about 2 hours ago
about 2 hours ago
about 2 hours ago

Tab Wrangler stores closed tabs in the 'Tab Corral', where you can quickly open them again.

REMOVE THE BLOATWARE

It's not just malware you want to get rid of – it's all the other bloatware that you might have installed or had installed on your PC. That includes all the unnecessary nonsense that hardware manufacturers pre-install, as well as third-party 'offers' that you inadvertently install when you're installing applications that you actually do want.

There's a free app called PC Decrapifier (**www.pcdecrapifier.com**) that's a godsend for cleaning out this stuff. It uses community-based recommendations for applications to clear off PCs. Download and install it, then run the app. It will analyse your system and come up with a list of apps it recommends uninstalling, as well as a list of other questionable apps. Next to each app, you'll see a percentage: that's the proportion of users that recommend uninstalling it. Just check the boxes next to any and all you want to remove, then click on the 'Remove Selected' button.

REDUCE STARTUP ITEMS

A lot of apps like to start when Windows starts – but they don't really need to, and they just make the bootup process longer. In Windows 8 and 10, you can now easily control what starts with Windows. Just fire up the Task Manager and click on the 'Start-up' tab. It will list start-up items and their system impact, and let you choose to disable them. Just click on the name of the item, then on the 'Disable' button. In Windows 7, you can use MSConfig – just type "msconfig" in the search bar, then click 'msconfig.exe' and go to the Startup tab.

CLOSING TABS

A lot of users find that the major resource sucker is their web browser – and that's usually because they're the kind of person who likes to keep dozens of tabs open. If you're keeping 20, 30 or 50 web pages open, with their animations and videos and scripts and other things running, it's no wonder that your system is struggling. It's time to manage those tabs.

For Chrome, you should try to grab the Tab Wrangler add-on from the Chrome Web Store. This add-on closes tabs that have been idle for a while – but stores them in a list so you can easily open them again when you finally want to see them (you can also lock tabs open if you want). There's a similar add-on for Firefox called AutoClose Tabs, available from the add-on manager.

TONE DOWN WINDOWS ANIMATIONS

Particularly if you're using integrated graphics, toning down some of the Windows effects can help. Right click on the Start button and select System. Then click on 'Advanced system settings', then, under 'Performance', click on the 'Settings' button. You'll see a lot of switches you can turn on and off to remove Windows flair. You can also click on 'Adjust for best performance' to turn them all off.

DEFRAGGING

Defragging reorganises the data on your disk for optimal performance. It's not as important as it used to be with the old FAT32 file system and it's unnecessary on SSDs, but it still has a notable effect on mechanical hard drives. Just type "defrag" into your Windows search bar, and start the Defragment and Optimise Drives app. Run a Defrag process and schedule it if you haven't already.

REFRESH (AS A LAST RESORT)

If all else fails, a refresh or reset will turn the clock back on your system and restore it to something resembling factory conditions. Check page 70 for this process. ■

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Mar 2016
Issue 426
RESTORE, REFRESH OR REINSTALL WINDOWS 10
FAST FIXES FOR TECH TROUBLES
THE ULTIMATE TROUBLESHOOTING GUIDES: 20+ PAGES OF ESSENTIAL KNOW-HOW FOR PC, MAC, ANDROID & iOS
TROUBLESHOOT ANYTHING!
SOLVE PROBLEMS WITH ANY DEVICE
COMPLETELY CLEAN A MALWARE-INFECTED SYSTEM
PLUS!
COMPACT PC PARTS ON TEST
MINI-ITX & MICRO-ATX MOTHERBOARDS BENCHMARKED & REVIEWED
GET ESSENTIAL TECH SKILLS
Install Android 6.0 on your PC or laptop
Make a home-brewed 'Steam Machine' PC
12 Raspberry Pi alternatives
Make your own Mac Fusion drive
INTRIGUING NEW PCs & TECH GEAR
ASUS Chromebit: a $150 stick PC running Google's ChromeOS
iPad to MacBook: keyboard cases to transform your tablet
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Mend a meandering Mac

Mac running slowly? These tips will help grease its cogs and shift it up a gear.

How to speed up a Mac is one of the most common requests, not least with Macs more than a few years old.

Slow performance is very irritating. However, Apple tests upgrades to OS X against older machines and makes sure they're capable of running correctly, so if you're experiencing slowdown, it's usually fixable.

Having said that, El Capitan was a significant operating system upgrade from Yosemite, with plenty of additional features. If you are encountering slow performance, the very first step should be to empty the Trash. OS X needs some free space to move files around, and typically, we advise around 10% of your hard drive space, or at least 10GB.

Before you even start to examine your disk space, get rid of any unwanted files. Items stored in Trash are taking up valuable disk space, so right-click it and choose 'Empty Trash Now' to purge them from your Mac.

Check the available disk space by clicking 'Go > Computer' from the Finder menu bar, selecting the icon for your main hard disk and choosing 'File > Get Info' (Command-I). Available space is listed in the status bar (you might need to choose Show Status Bar). If you don't have at least 10GB free, it's time to delete or archive your old files. Good places to look are your Movies, Downloads and Documents folders. DaisyDisk ($14.99, **daisydiskapp.com**) can help you find space-hogging files.

Applications tend to take up a lot of space. You can drag apps you no longer use to the Trash or use an app like AppZapper (US$12.95, **appzapper.com**) to get rid of them.

Creating a backup with Time Machine is a good idea before you start to trash files. Connect an unused or new external drive with sufficient space, and go to 'System Preferences > Time Machine' to use it for backups.

Backing up to a directly connected hard drive is faster than using a drive such as the Time Capsule, which backs up over Wi-Fi. If you do have a Time Capsule, it's a good idea to connect to it using an Ethernet cable for the first backup. Even so, backing up several gigabytes of data will take an hour or two and will impact your Mac's ability to perform other tasks. After the initial run, only incremental changes will need to be backed up, so it's worth gritting your teeth and getting the first, full backup out the way.

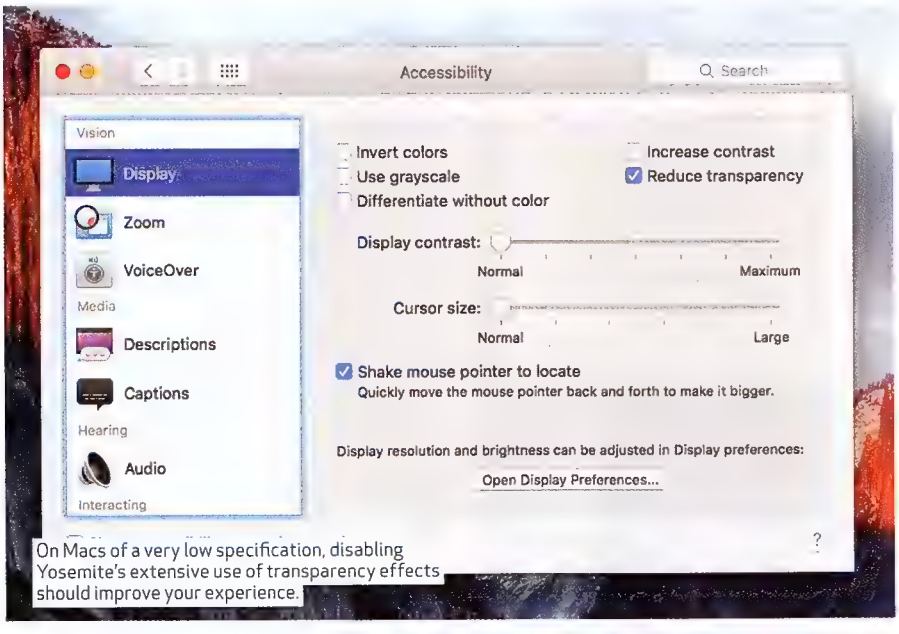
> "Items stored in Trash are taking up valuable disk space, so right-click it and choose 'Empty Trash Now' to purge them."

TURN OFF FEATURES

If you've freed up some hard drive space but are still experiencing slow performance, then it might be time to try disabling some features. To begin, go to 'System Preferences > Extensions > All' and deselect anything you aren't using.

Open 'System Preferences > Energy Saver'. On some older MacBooks, you may see 'Higher Performance' options. Choose this, then restart your Mac. This turns on the discrete graphics card, but it will drain the battery faster.

A good trick for older Macs is to uninstall Flash, as it's a resource hog. Of course, you won't be able to access Flash-based web content, but many sites have moved to a more modern HTML5 implementation now. You can find a Flash uninstaller at **adobe.ly/1P9sdfw**. In your web browser, remember to close down tabs and windows you no longer need as these are a drain on resources.



On Macs of a very low specification, disabling Yosemite's extensive use of transparency effects should improve your experience.

QUIT SOME APPS

App Nap is a built-in feature that slows down inactive apps. If an app is using valuable memory, recent versions of OS X will compress the data it has in memory. That isn't always possible; in which case, the OS will write incompressible data to disk to free up space for another app. Tell OS X that the memory used by those apps can be used by other things by quitting them.

If you find it hard to know which apps are open, in 'System Preferences > Dock' make sure 'Show indicators...' is enabled. To prevent napping apps reappearing after a restart, go to ' > Log Out...' and deselect 'Reopen windows when logging back in'. Turning off visual effects such as transparency, can deliver incremental but important performance gains. In 'System Preferences > Accessibility', turn on 'Reduce transparency'.

Even if text doesn't seem blurry, go to 'System Preferences > General' and toggle 'Use LCD font smoothing' to check its appearance before and after.

MacBooks that start up slowly may not have been fully shut down the last time. This can happen if you closed the lid of your MacBook before the shutdown process finished, so don't be too hasty when powering down for the day.

After following these tips, you should find OS X runs much faster. ■

Aid an addled Android

Don't use your sluggish Android device as an excuse to buy a new one. Darren Yates looks at tricks to take the handbrake off.

Android is a great OS, but you need to keep it on a short leash, otherwise, it can take over. If your device has plenty of get-up-and-stop, have a play with these options.

DISABLE AUTOMATIC UPDATES

Auto-updates are one of those hidden performance suckers. Not only does Wi-Fi speed take a hit as these updates download, they use CPU time, slowing other apps. Launch the Google Play app, swipe in from left to get the menu, tap 'Settings > Auto-update apps' and select 'Do not'. Repeat and choose 'Update via Wi-Fi only' to turn it back on again.

TURN OFF LIVE WALLPAPER

Yes, it looks pretty, but it's pointless. Anything your phone does chews up CPU time, so why waste it? Press and hold on an empty part of the home screen, tap 'Wallpapers' and choose an image instead.

TRY THE BUILT-IN CPU MONITOR

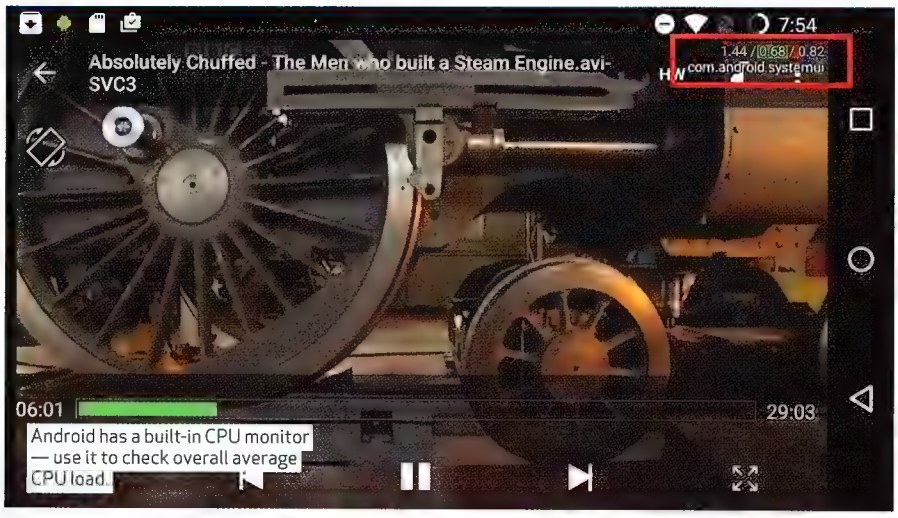
If you suspect one or more apps have gone 'rogue', monitoring the CPU load will give you an idea if there's a problem. There are plenty of CPU monitoring apps on Google Play, but here's how to use the one built inside Android.

Head to 'Settings > About phone', scroll down to 'Build number' and tap it five times to enable Developer options. Go back to 'Settings > Developer options > Monitoring' (near the bottom) and turn on 'Show CPU usage'. You should now see three tiny numbers appear top-right — they show the live average CPU load over the last one, five and 15 minutes.

To read the numbers, count up the number of cores in your device CPU and that's your '100% capacity' or peak number, meaning the CPU is running at full capacity. For example, my quad-core Samsung Galaxy S3's peak-number is 4.0. On a dual-core box, it's 2.0. Any higher than that number and you have CPU overload. Ideally, the lower the better. Follow the same steps again to switch it off. Or try OS Monitor on Google Play. Either way, only use CPU monitoring temporarily.

DISABLE ANIMATIONS

App window animations are standard fare for Android, but if you're desperate for more speed, switch off this eye candy. Go back to 'Developer options > Drawing' and set 'Window animation scale', 'Transition animation scale' and 'Animator duration scale' either to 'Off' or drop to '1x' instead of the default '2x'. This scales back animations.

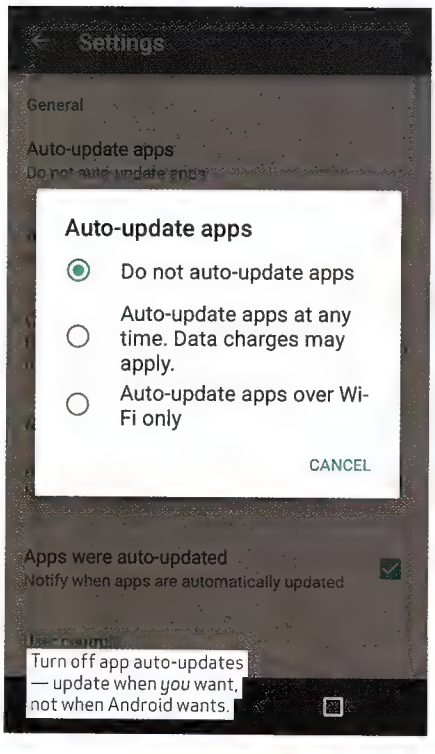

7:54
Absolutely Chuffed - The Men who built a Steam Engine.avi-SVC3
com.android.systemui
06:01
29:03
Android has a built-in CPU monitor — use it to check overall average CPU load.

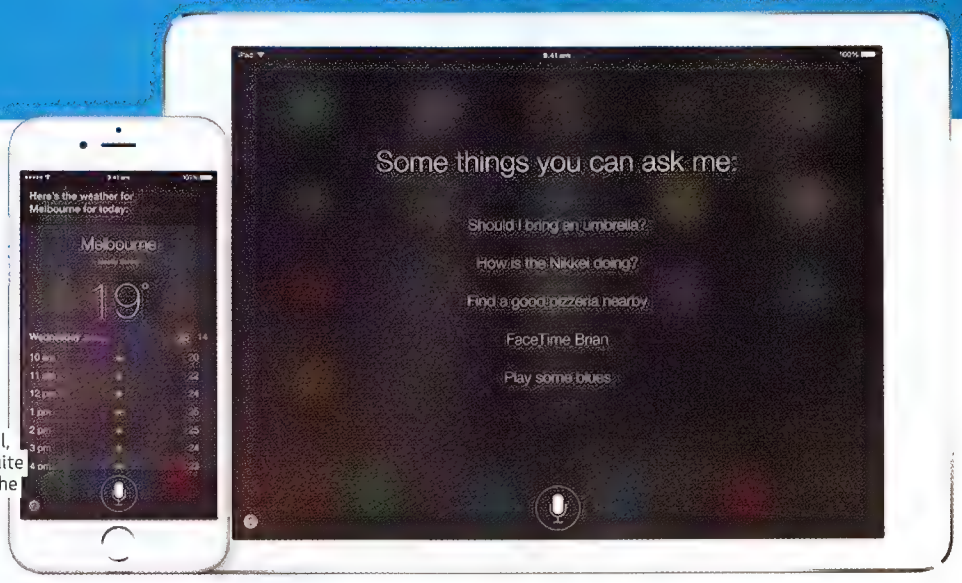
FOOT TO THE FLOOR!

This is a 'break only in emergency' tweak for custom ROMs with CPU kernel options. The CPU governor is a bit like your car's gearbox and sets how CPU power scales. Setting this to 'performance' should see it hit peak a little faster if action-lag is your problem. Some kernels allow overclocking, but few devices are set up for it, so give it a miss.

IN A HURRY? REBOOT.

This sounds like a helpdesk joke, but seriously, rebooting your Android device shuts down all open apps, which might just be enough to resurrect performance on its own. ■


Settings
General
Auto-update apps
Auto-update apps
Do not auto-update apps
Auto-update apps at any time. Data charges may apply.
Auto-update apps over Wi-Fi only
CANCEL
Apps were auto-updated
Notify when apps are automatically updated
Turn off app auto-updates — update when you want, not when Android wants.



Siri can be very useful, but also consumes quite a lot of resources in the background.

Improve an inert iPhone or iPad

iOS devices aren't immune to slowdown over time either. Lindsay Handmer reveals the top tricks to get it running more smoothly.

With every update of iOS, older devices seem to bog down and suffer from lag. iOS 9 has been particularly unkind to the iPhone 4S (and there's even a lawsuit against Apple about it) but, fortunately, there are a few ways to speed up your experience. Of course, first try a hard restart – hold down the power and home button for around 10 seconds until an Apple logo appears.

DIAL BACK THE VISUALS

iOS has some fancy eye candy that older hardware struggles to render. Turning off transparency (iOS 9) and animation motion can reduce lag. Head to Settings › General and then Accessibility. Toggle the Reduce Motion option to on. Navigate one layer deeper to Increase Contrast and turn Reduce Transparency on. Sure, it won't look quite as nice any more, but a smoother, faster experience is worth the trade-off.

CORRAL SIRI

One of the new features of iOS is Siri Suggestions – a kind of proactive behind the scenes search. It does use extra resources, though, so turn it off to speed things up. Head to Settings › General › Spotlight Search and toggle Siri Suggestions to Off. For older versions, head to the same place but turn off Spotlight Suggestions. You can also manually disable the functionality individual apps.

DISABLE BACKGROUND APP REFRESH

iOS has a handy feature that lets apps keep up to date behind the scenes, so they have the latest info when opened. This does use some extra resources, though, so turning it off can improve general speed and even boost battery life. Head to Settings › General › Background App Refresh and turn it off. Apps now update when opening instead.

TURN OFF AUTOMATIC UPDATES

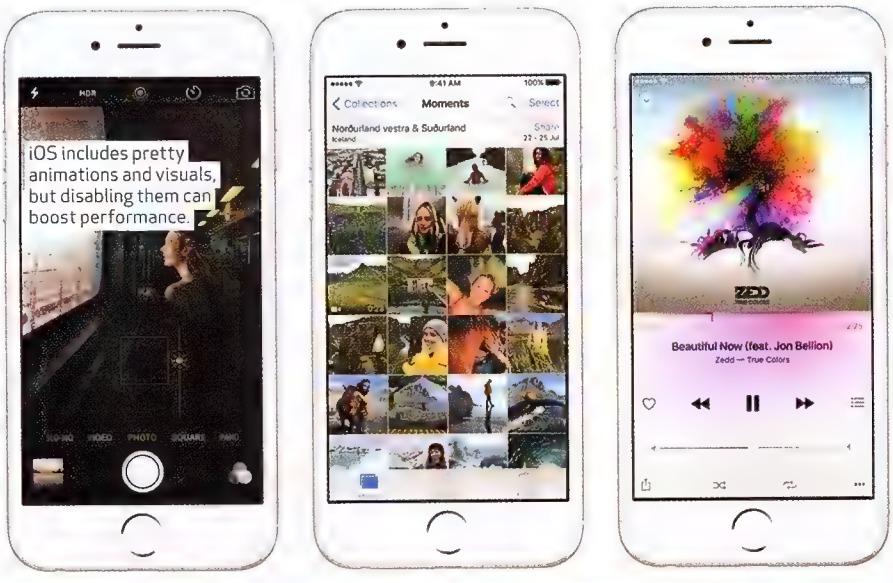
OS, app and other automatic background updates and installs can take a toll on front-end performance. Turning them off can leave your phone out of date, but you will need to select updates manually. Navigate to Settings › App and iTunes Stores and toggle Updates to off. Always check you have the latest version of iOS available, as various bug fixes can improve performance.

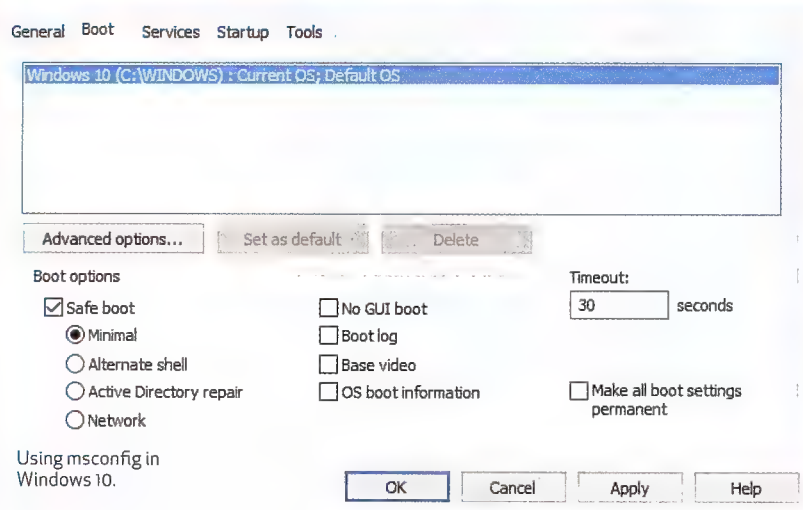
A FRESH START

If your iOS device is still sluggish, resetting it to the factory configuration can help. This totally wipes all data and apps, so make sure you are fully backed up. Connect your iPhone or iPad via USB to your computer and fire up iTunes. Select your device, then click the Summary tab, then the Restore button and follow the prompts. To reset without iTunes, navigate to Settings › General › Reset › Erase All Content and Settings and click 'Erase iPhone'.

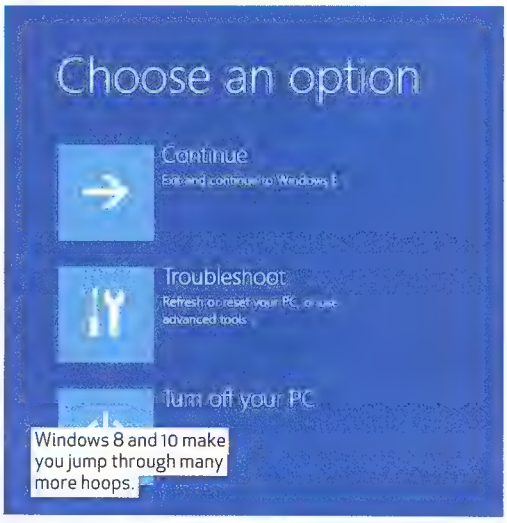
DOWNGRADE IOS

After every iOS update, there is a very short window of time where it is possible to roll back to the previous version. If you experience major performance issues with an update, then downgrading is a useful option. The easiest way is to use iTunes to create an archived backup (not just a normal backup) before upgrading. If the update causes problem, restore the backup and don't update again. ■


iOS includes pretty animations and visuals, but disabling them can boost performance.
Collections
Moments
Select
Beautiful Now (feat. Jon Bellion)
Zedd — True Colors



Using msconfig in Windows 10.



Windows 8 and 10 make you jump through many more hoops.

Completely clean a malware-infested PC

It's a sad fact that many PC problems are caused by malware. Nathan Taylor explains how to proceed in a worst-case scenario.

So the worst has happened and you've become infected with a virus – or maybe just a bunch of stuff you don't want. The PC slows right down, web pages are loading when you don't want them to, there are constant popups and other stuff happening that you never asked for. Now the final solution to such a problem is to perform a refresh/reset on the PC (which we cover on page 70) – but before you nuke your PC from orbit, so to speak, there are some things you can try without deleting all your programs in the process. Just follow these four steps.

BOOTING INTO SAFE MODE

It can be tricky to remove malware. Once it infects a PC, most malware will actively try to prevent you from removing it. Control panels won't open, you can't access Task Manager to close processes and other common techniques for shutting down and removing processes may be thwarted. That's why you have to boot into safe mode. Safe mode prevents anything other than core Windows components from loading, so the malware won't be loaded into memory and you can actually remove it from the hard drive.

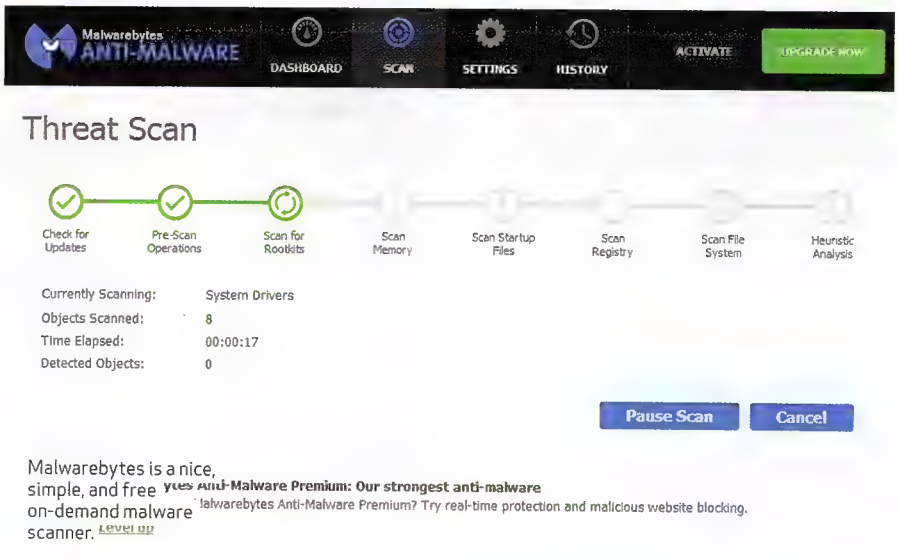
Booting into safe mode is easy – although Windows 8 and 10 actually made it a little harder. For Windows 8 and 10, remove any USB drives and DVDs/CDs from the drive. Then click on the Start button, then on the power button, then while holding down the shift key, click on Restart. This will restart with Advanced Options open.

Alternatively, press the Windows key and 'R' to bring up the Run menu. Type `msconfig` into the Run box. Click on the Boot tab and check the Safe Boot option. Then reboot the computer.

If you're running Windows 7 or earlier, you can use the good old F8 key. Just reboot, and while the computer is booting, jam the F8 key. Just keep pressing it over and over. Instead of booting into Windows normally, the advanced boot options page will open. (As an aside, it is possible to re-enable F8 in Windows 8 and 10; you have to open the command prompt from 'cmd.exe' and type the command "bcdedit /set {default} bootmenupolicy legacy". This will slow down your bootup slightly, but F8 will work again.)

Once that's done, you'll either get the old text-based page (for Windows 7) or the fancy new Advanced Options page (Windows 8 and 10).

In the old page, just arrow down to choose Safe Mode with Networking. In the new one, you have to select Troubleshoot > Advanced Options > Startup Settings. Then you have to do a restart and then you finally get to choose 'Enable Safe Mode with Networking'.



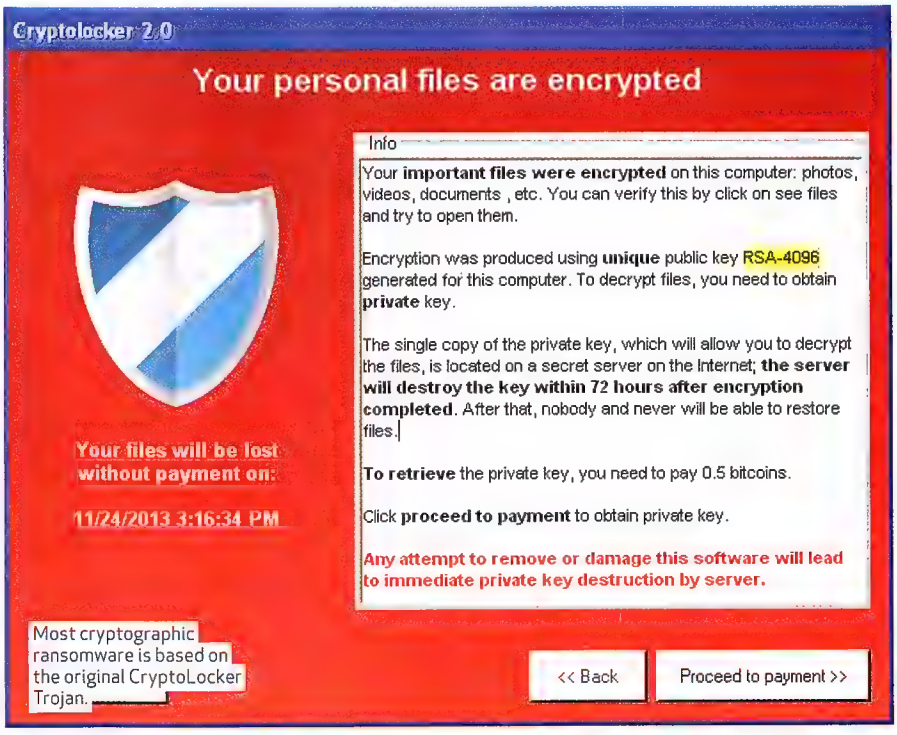
Malwarebytes is a nice, simple, and free on-demand malware scanner. Level up

Cryptographic ransomware

One of the reasons we recommend Malwarebytes over, say, Norton, is that it removes unwanted programs as well as viruses.

Ransomware is a major category of unwanted program. At its most benign, it just gives you dire popups warning you of impending computer doom if you don't buy and install a particular application. A malware scanner can get rid of those easily, no harm done. But then there are the truly horrible cryptographic ransomware applications. These encrypt a portion of your hard drive (usually your user directory or photographs) and direct you to go to a certain website and follow instructions to pay several hundred dollars if you want your stuff back. There is no complete fix for this. An anti-malware app can remove the trojan, but won't be able to unencrypt your data. So either pay or lose your data. Most ransomers have historically honoured the agreement and provided the decryption key to payers. In some cases (such as with the original CryptoLocker virus), police caught and seized the ransomers.

If you're the victim of cryptographic ransomware and are a subscriber to a security suite service, call your security software provider. If you're not, check how up to date your backups are. If you have recent backups, you can just do a system reset and use your backups. You can also check out **www.scamwatch.gov.au** for the latest on scams and how you might best deal with them.


Cryptolocker 2.0
Your personal files are encrypted
Info
Your important files were encrypted on this computer: photos, videos, documents , etc. You can verify this by click on see files and try to open them.
Encryption was produced using unique public key RSA-4096 generated for this computer. To decrypt files, you need to obtain private key.
The single copy of the private key, which will allow you to decrypt the files, is located on a secret server on the Internet; the server will destroy the key within 72 hours after encryption completed. After that, nobody and never will be able to restore files.
To retrieve the private key, you need to pay 0.5 bitcoins.
Click proceed to payment to obtain private key.
Any attempt to remove or damage this software will lead to immediate private key destruction by server.
Your files will be lost without payment on:
11/24/2013 3:16:34 PM
<< Back
Proceed to payment >>

Most cryptographic ransomware is based on the original CryptoLocker Trojan.

Run another anti-virus app just in case. Even if it is Windows Defender/ Security Essentials.

BACK UP YOUR IMPORTANT STUFF

Once you've booted into safe mode, back your important stuff up to an external hard drive or flash drive.

RUN MALWAREBYTES

There are a number of on-demand malware scanners, but Malwarebytes is a great choice. It checks for and removes virus infections, as well as other potentially unwanted programs (PUPs) like browser toolbars and popups that many applications don't register as viruses and leave intact. You can install and run it in safe mode. Head to **www.malwarebytes.com** and download and install Anti-Malware Free. Run it once it's installed.

For most infections, the defaults are good (it will remove PUPs by default). Just click on the Scan button and, with Threat Scan selected, click on Start Scan. It will roll through the process and (hopefully) find what is messing with your system and give you the option to remove it.

If Malwarebytes doesn't pick up your problem, there are other good solutions you can try. HitmanPro 3 (**www.surfright.nl**), Comodo Cleaning Essentials (**www.comodo.com**), Emsisoft Anti-Malware (**www.emsisoft.com**) and Avast Free AntiVirus (**www.avast.com**) all also include anti-malware as well as anti-virus.

REBOOT YOUR COMPUTER

Once the scan is complete and the virus/malware is removed, you can return to your normal business. Reboot the computer and, if the malware was removed, everything should be good again. It's a good idea to run another virus scanner, just to be sure, such as BitDefender, Kaspersky, AVG and other offer free solutions. You can also finally take the time to set up a proper backup system and create a recovery drive (just type `recovery drive` in the Windows 10 search bar to get going).

CHANGE YOUR PASSWORDS

Finally, it's time to go through and change your passwords for all the important things. While you were infected, you may well have had your passwords harvested, and you'll now have to go through and update your passwords to new ones. It sucks, we know, but it's a necessary precaution.

Restore, refresh or reinstall Windows

Is your PC behaving strangely or sluggishly? Read on to discover your options for restoring Windows 10 to its best.

Windows 10 is pretty bulletproof, but if you're unfortunate enough that something should go wrong, what can you do to get your machine back up and running?

Thankfully, the latest version of Windows comes with everything you need to take charge of the situation and fix problems using a combination of different tools. In this feature, we'll show you how to make sure your important data is backed up first, and then we'll investigate the various utilities that can bring your device back to life, from a simple rollback of key system files and settings to a full-blown reinstall of Windows itself. It could be that a simple restore will do the trick instead of a more radical reinstalling of Windows.

Back up your files online

Add an extra layer to your emergency recovery plan

As anyone who has experienced a hardware failure will know, you can never have too many backups, so even after using File History to back up your files, you should explore another option, just in case. We recommend using an online backup, because it means there's a copy of your files stored in a separate physical location for extra protection.

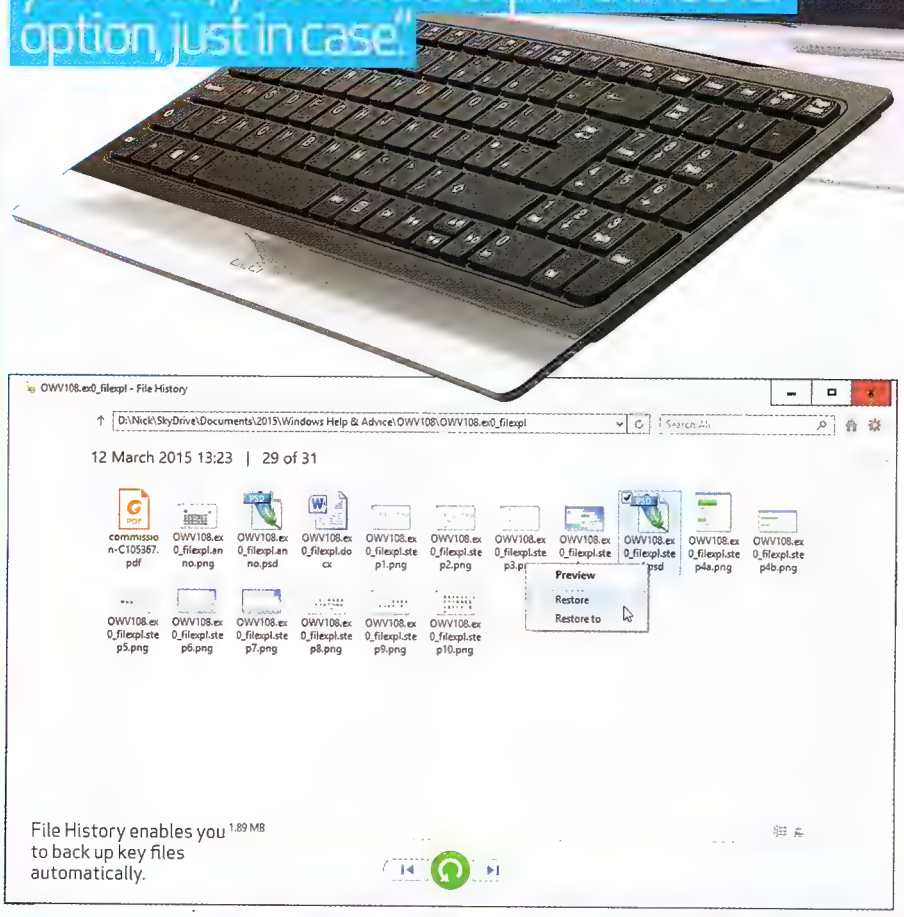
The obvious choice for Windows 10 users is to use the free OneDrive desktop app, which enables you to sync up to 5GB of files to the cloud for absolutely nothing. You'll find it on your Start screen — just click (or tap) on the OneDrive tile to launch it.

If you need more storage space, you can purchase additional gigabytes in the 'Manage storage' – Upgrade area of OneDrive online.

Up to 15GB is free and up to 50GB requires a monthly payment of just $2.

Pay $12 a month, however, and you'll get Office 365, plus a whopping 1TB of storage too.

> "You can never have too many backups, so even after using File History to back up your files, you should explore another option, just in case."



File History enables you to back up key files automatically.

Take a backup

Keep your work safe with the File History feature.

Taking the steps required to protect your saved files is crucial. Think about the priceless photos, home movies, music library, important work documents and other irreplaceable files and settings that would be lost in the event of a disaster! The good news is: backing up files couldn't be easier, and the tools you need are provided in Windows 10 itself.

When it comes to backing up your files, the File History tool is your first port of call. To access it, click 'Start > Settings > Update & security > Backup', then follow theprompts to set it up to work with your backup drive, whether that's an external USB drive, a network share or network attached drive.

By default, the built-in File History tool automatically backs up all the content from your libraries, contacts, favourites, OneDrive folder and desktop. If you want to back up any folders as well, you can do so by adding them to a library, and you can choose 'Exclude folders' from File History's 'More options' screen if you want to remove specific folders from the backup.

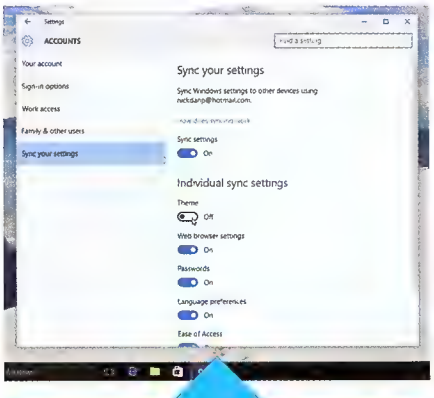
Once you've set everything up, click 'Turn on' (if it's not done for you) and File History not only starts backing up your files, but backs up different versions of them, too, enabling you to roll back files to earlier revisions.

QUICK RECOVERY

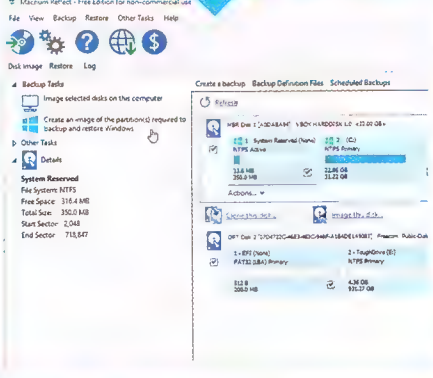
There are two ways to recover files. Firstly, if you want to restore lost or accidentally deleted files, click 'Restore files from a current backup' in the 'More options' section of File History. From here, you can browse your backups by location or library, or search for specific content.

If you want to restore an earlier version of a file, the process is just as simple. All you need to do is browse for it in an Explorer window, select the file in question and then click the 'History' button on the Home tab of the ribbon to see a list of previous versions of the file before restoring the one you want.

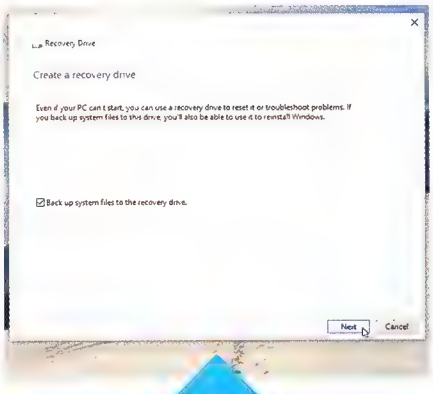
When it comes to backing up other key settings and files, the step-by-step guide opposite reveals all the tips, tools and tricks you need to keep all aspects of your PC safe.



Back up your settings



Take a drive image


Recovery Drive
Create a recovery drive
Even if your PC can't start, you can use a recovery drive to reset it or troubleshoot problems. If you back up system files to this drive, you'll also be able to use it to reinstall Windows.
Back up system files to the recovery drive.
Next
Cancel

Create rescue media

Restore or roll back your PC

If the problem with your device is only relatively minor, then you can often fix it without affecting your data.

Your PC has run into problems and you have exhausted all troubleshooting angles, so what can you do to try to get things working properly again? The next step in Windows 10, like earlier versions of Windows, is to investigate the System Restore tool. System Restore works in a similar way to File History, only it affects system and program files instead of your personal data. Snapshots of these files, known as Restore Points, are taken at key moments during general use, and if you run into problems, you can try rolling back to a previous Restore Point to see whether it fixes the problem.

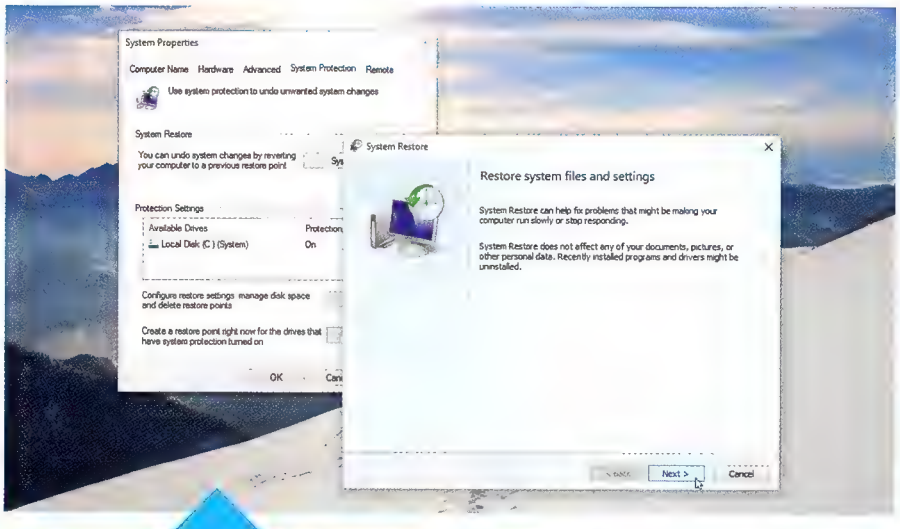
System Restore usually works best when your problem has been caused by a recent change to your computer, typically through installing or updating new hardware, software or Windows itself. The step-by-step guide opposite (see 'Send your PC back in time') reveals how to access and use System Restore, either from within Windows or via your computer's recovery menu.

ROLLBACK YOUR PC

If System Restore doesn't do enough to fix the problem, then you can perform a more radical step: go back to the previous build of Windows 10.

When you perform a major update of Windows, or Windows 10 installs a major new version, it creates a backup of the previous build, just in case you run into any problems. This backup is stored in the Windows.old folder – it can take up a fair bit of space, and can be removed using Disk Cleanup, but if you have the spare capacity, leave it in place in case you ever need to use it to fix a problem.

Rolling back your system in this

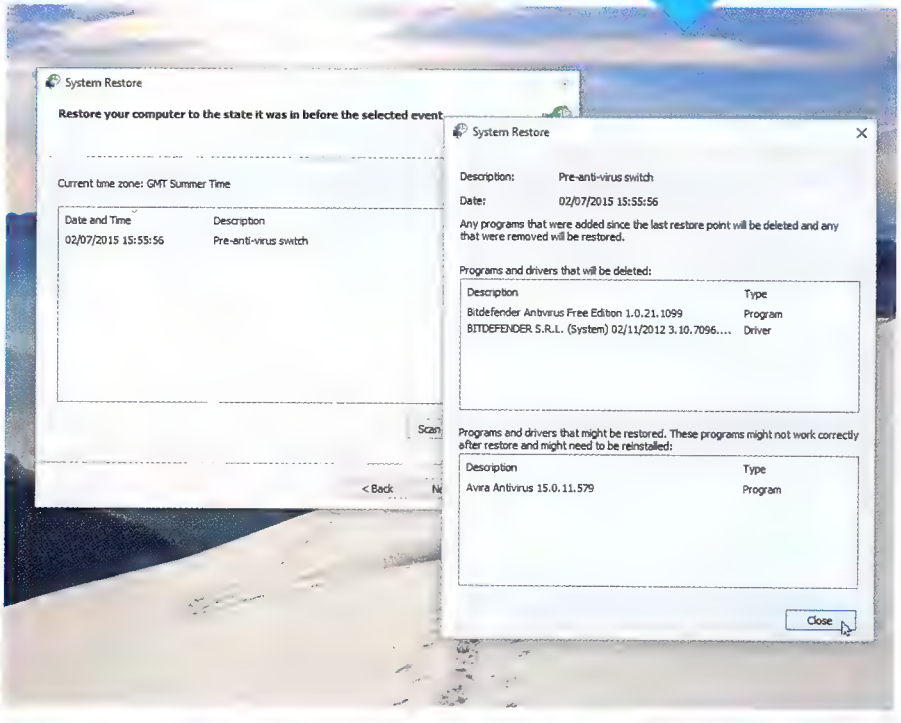

System Properties
Computer Name
Hardware
Advanced
System Protection
Remote
Use system protection to undo unwanted system changes
System Restore
You can undo system changes by reverting your computer to a previous restore point
Protection Settings
Available Drives
Local Disk (C:) (System)
On
Configure restore settings, manage disk space and delete restore points
Create a restore point right now for the drives that have system protection turned on
OK
System Restore
Restore system files and settings
System Restore can help fix problems that might be making your computer run slowly or stop responding.
System Restore does not affect any of your documents, pictures, or other personal data. Recently installed programs and drivers might be uninstalled.
Next >
Cancel

Restore Points

[illegible]

System Restore

[illegible]


System Restore
Restore your computer to the state it was in before the selected event
Current time zone: GMT Summer Time
Date and Time
Description
02/07/2015 15:55:56
Pre-anti-virus switch
Scan
< Back
System Restore
Description: Pre-anti-virus switch
Date: 02/07/2015 15:55:56
Any programs that were added since the last restore point will be deleted and any that were removed will be restored.
Programs and drivers that will be deleted:
Description
Type
Bitdefender Antivirus Free Edition 1.0.21.1099
Program
BITDEFENDER S.R.L. (System) 02/11/2012 3.10.7096....
Driver
Programs and drivers that might be restored. These programs might not work correctly after restore and might need to be reinstalled:
Description
Type
Avira Antivirus 15.0.11.579
Program
Close

way works in a similar fashion to System Restore: your data is unaffected, but any changes made since the new build was installed, like changes to settings or programs, newly installed apps, and so on, will be undone.

If you need to use the rollback feature, and Windows is working well enough for you to access it normally, open Settings before selecting 'Update & security', followed by 'Go back to an earlier build'.

If Windows won't boot, use your recovery drive or select 'Troubleshoot > Advanced options' to access the option.

You'll see a message telling you Windows is getting things ready. You'll then be asked to give a reason for why you're rolling back Windows – this helps highlight issues that may require an urgent fix.

You'll then be given a brief summary of the changes being made (no specific details are available, unlike with System Restore, sadly), with a prompt to back up for safety's sake (if File History is turned on, you're probably covered). Click Next, make a note of the warning about your logon password and then click Next again, sit back and wait while your PC is restored.

If all goes well, you should have a working version of Windows 10 again, with just a few maintenance tasks to perform (reinstalling programs, updating settings, and so on) before everything's back to normal.

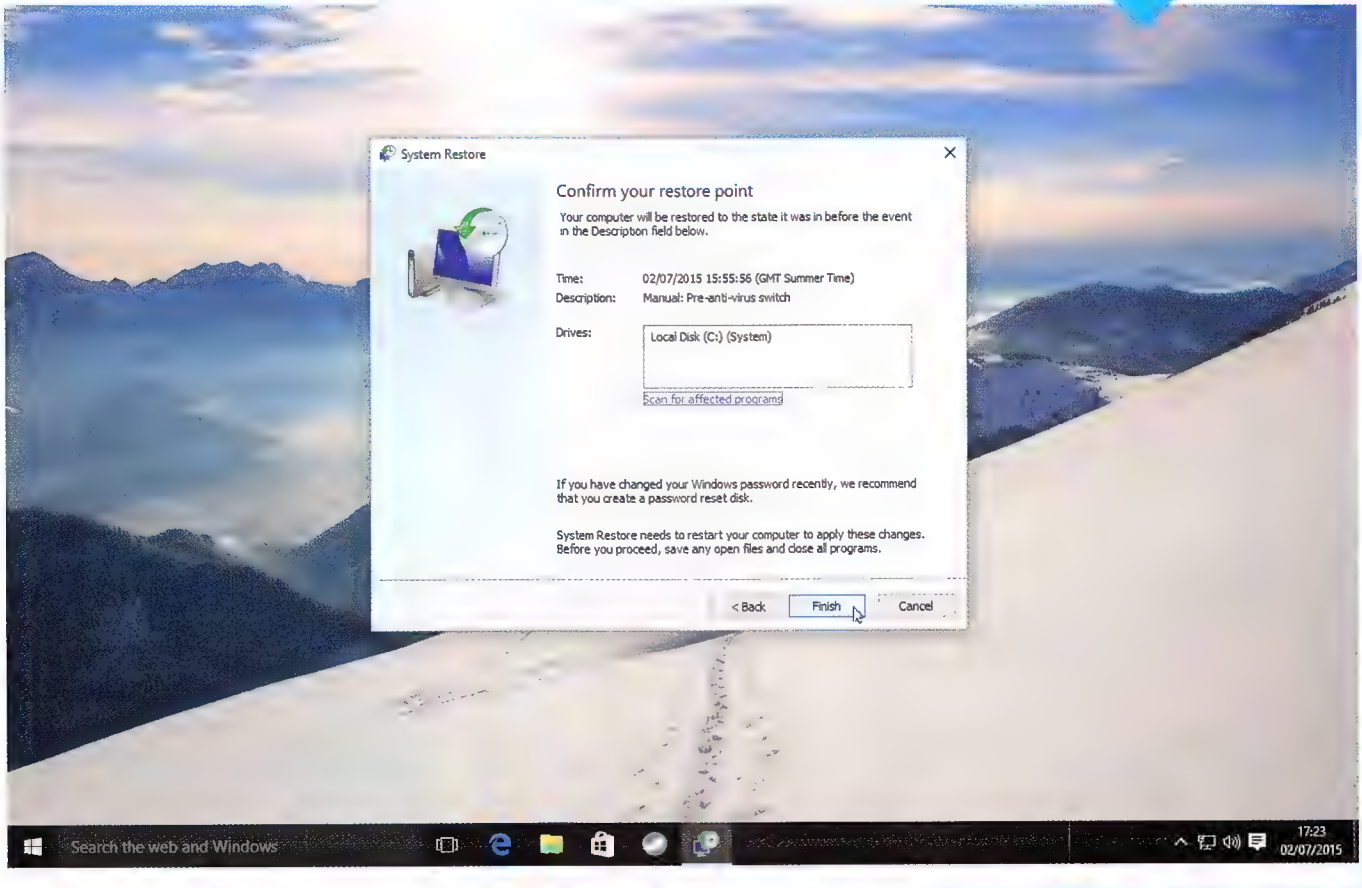
BEYOND A ROLLBACK

Unfortunately, rolling back your PC to the previous version of Windows 10 won't always cure all issues. You may find your device still doesn't function as it should after you've refreshed it, or the procedure might not work. If Windows comes across a problem, it'll inform you of the fact, try to resolve it and then, if the fix fails, undo all the changes it's made, leaving you where you started.

If all else fails, fixing your PC will involve something more drastic: a complete wipe and reinstall of Windows itself in what is now termed a 'reset' of your PC. You can perform this without losing your data or by wiping the drive entirely, but the end result is the same: you'll lose all your settings and apps.

> "System Restore usually works best when your problem has been caused by a recent change to your computer, typically through installing or updating new hardware, software or Windows itself."

Send your PC back in time


System Restore
Confirm your restore point
Your computer will be restored to the state it was in before the event in the Description field below.
Time: 02/07/2015 15:55:56 (GMT Summer Time)
Description: Manual: Pre-anti-virus switch
Drives: Local Disk (C:) (System)
Scan for affected programs
If you have changed your Windows password recently, we recommend that you create a password reset disk.
System Restore needs to restart your computer to apply these changes. Before you proceed, save any open files and close all programs.
< Back
Finish
Cancel
Search the web and Windows
17:23
02/07/2015

Reinstall or recover

If all else fails, a full recovery or reinstall will fix your problem — but make sure you've backed up first!

There's no need to tear your hair out if nothing seems to help with the troubleshooting. You can go the whole hog, wipe your hard drive clean and restore Windows to its factory settings. This approach will delete any personal data you have saved on the drive, so make sure it's fully backed up first using our guidelines earlier.

It's also a good idea to make a note of any programs you've installed on your PC so you can download and restore them after Windows has been reinstalled.

REINSTALL WINDOWS

Microsoft knows how painful the reinstall process can be, which is why, with Windows 10, it's gone out of its way to make the process easier than ever.

The simplest way to reinstall Windows is through Windows itself. Click 'Start > Settings > Update & security > Recovery' and then choose 'Get started' under 'Reset this PC'. A full reinstall wipes your entire drive, so select 'Remove everything' to ensure a clean reinstall is performed. If Windows fails to load, you should be shown the troubleshooting screen, which you can also access via your recovery drive if you created one. In these circumstances, select 'Troubleshoot' followed by 'Reset your PC'.

One of the benefits of this new approach is that Windows attempts to recover from a previously created system image or, failing that, using a special series of install files that download the latest version of Windows during the reinstall process. In practical terms, this means you'll avoid a lengthy series of post-install updates to download and install in order to bring Windows itself back up to date. The reset process is simple: your PC reboots, then after a pause, while things are being prepared, you may be confronted by a screen asking you if you want to remove files from all of your drives, or just the drive that Windows is installed on.

Unless you're disposing of the PC, select 'Only the drive where Windows is installed' to protect data files stored on other partitions or drives.

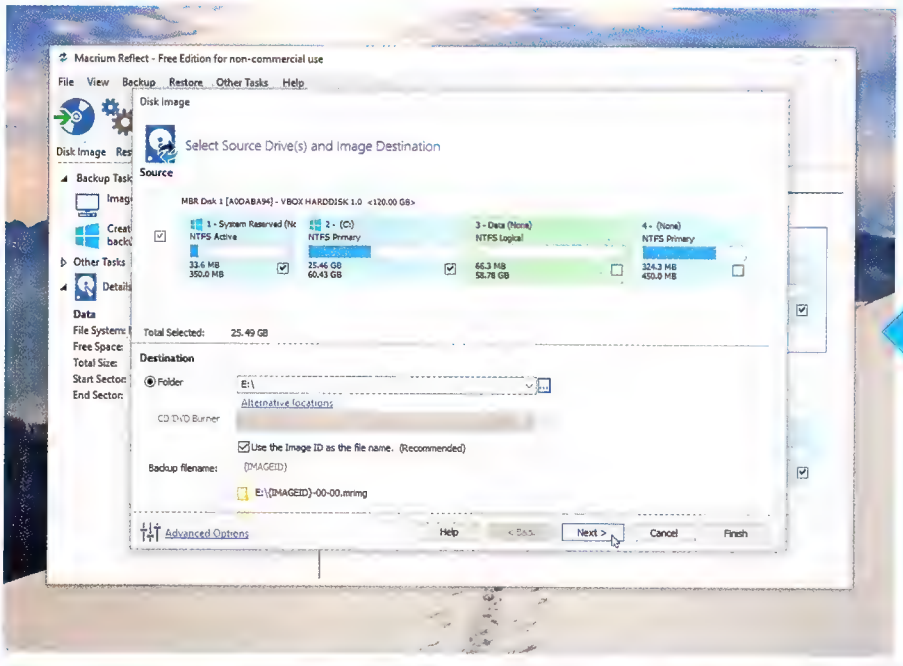
You'll also be given an option to 'clean the drive fully' — again, skip this, unless you're selling your PC. Finally, click 'Reset' and let your PC do the rest.

POST REINSTALL

Once restored, you'll have a brand new system and it's time to reinstall your apps, apply preferences and restore backed-up data.

The step-by-step walkthrough shown below reveals everything you need to know. Of course, you'll need to reinstall your key desktop applications, too, after this has been done. Again, take the time to download the latest versions and set each one up. This can all take an hour or two — to speed up future reinstalls, check out the box below-right to create the perfect Windows image, complete with all your apps, programs and settings in place.

> "One of the benefits of this new approach is that Windows attempts to recover from a previously created system image."



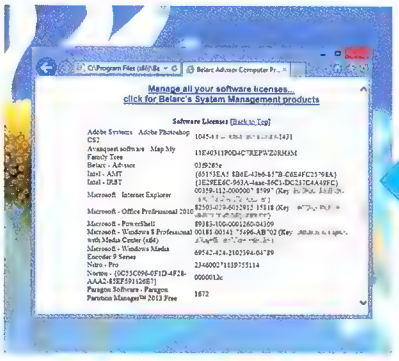
Speed up future Windows reinstalls

Set your perfect Windows setup quickly and easily next time you have to reinstall

Reinstalling and setting up Windows again can be a more, to speed up future reinstalls by creating a perfect recovery image. After reinstalling Windows and apps, reinstall your key programs and set them up as you like them. Then, before you restore your File History backup, launch Macrium Reflect Free and take a new drive image. Create a recovery CD or USB stick following the prompts, and next time you need to reinstall Windows, make sure your File History backup is up to date, then boot from your recovery media before restoring this drive image. All you'll need to do is bring Windows and your apps up to date, and reinstall new programs. Before restoring your File History backup, create a new drive image to use the next time you need to reinstall Windows.

Handy recovery tools

Five freebies to help you get going again in Windows 10.

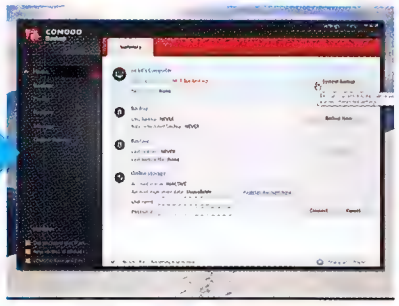


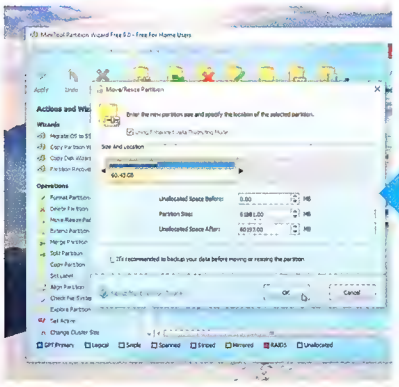
Belarc Advisor

Lost or forgotten your Windows or software product keys? Get them back before reinstalling with this. **www.belarc.com**

Comodo Backup

This tool gives you granular control over what you back up. **www.comodo.com**



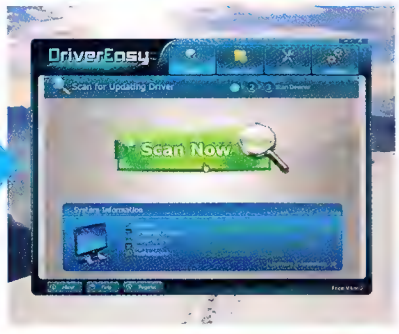


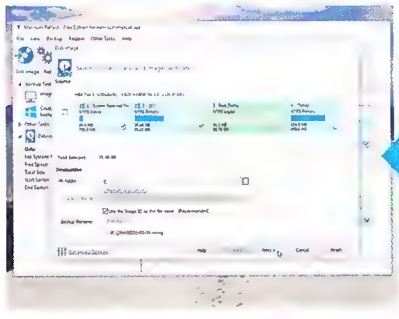
Partition Wizard Home Edition

Partitioning your hard drive lets you separate your data from your programs. **www.partitionwizard.com**

DriverEasy

This handy tool finds and installs any hardware drivers you can't identify after reinstalling Windows. **www.drivereasy.com**



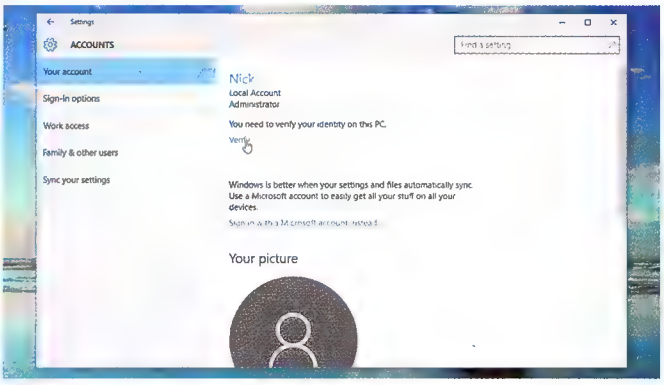


Ninite

This toolkit lets you select lots of popular apps, then download and install them all in a single package. **www.ninite.com**

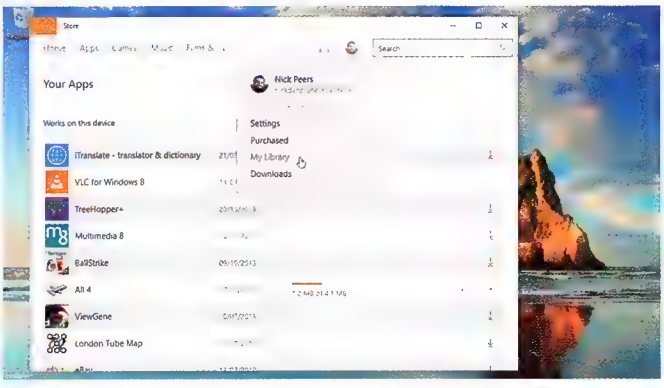
Use your backups

Restore settings, apps and files.



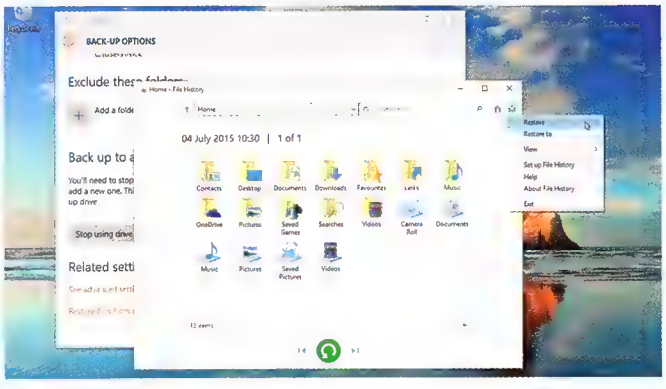
1 RESTORE SETTINGS

You'll need to log into your Microsoft account in order to restore your synced settings and previously installed apps. Before these are all restored, you'll need to verify your account on this device: click 'Start > Settings > Accounts > Your account' and click the 'Verify' link to get the code required to add your PC back into the trusted list.



2 RESTORE APPS

Open the Windows Store ('Start > All Apps > Store'), click your user photo and choose 'My Library' to access all previously installed apps (and your settings). Click 'Show all' and then click the download button next to each app you wish to restore. Once done, click your user photo again, but this time, choose 'Downloads' to update the built-in apps.



3 RESTORE FILES

Finally, restore your files using File History. With your back-up device plugged in, click 'Start > Settings > Update & security > Backup'. Click 'Add a drive' to select your back-up device, then click 'More Options' followed by 'Restore files from a current backup'. Click the Settings cog and choose 'Restore' to recover your data.

how to

» QUICK TIPS

Experts solve your computing problems

APC and its readers can be one giant helpdesk. If you have a technical problem, chances are one of us can solve it.

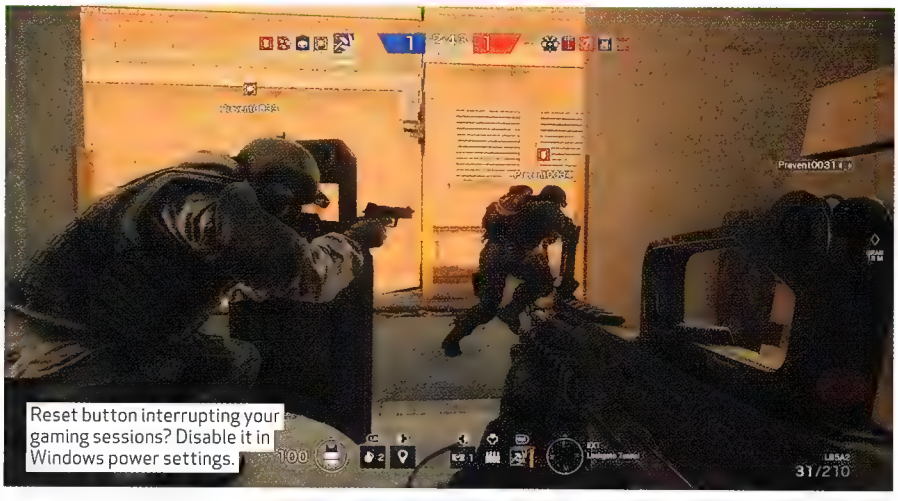
HARDWARE

BUMP AND BOOT

I've just finished building my no-expense-spared rig. I'll spare you all the specs, but trust me — it's pretty beefy. One problem, though, is the power and reset buttons on my Antec 902 case.

I keep knocking them with my knee when I'm sat at my desk. When it's off, hitting the power button turns the PC on, which is annoying, but much, much worse is hitting the reset button when I'm in the middle of Rainbow Six multiplayer! Can I turn the reset button off somehow, when I'm playing games, but still have it available in Windows?

Dani Clerbonne



Reset button interrupting your gaming sessions? Disable it in Windows power settings.

You can disable the power button in software. In Windows 8, search for 'Edit Power Plan', select 'Advanced' and scroll through to 'Power buttons and lid'. There, you can set the action for the power button to 'Do nothing'. This is a bit of a pain to toggle on and off each time you want to play games and it doesn't help with the reset button. That button is wired directly to the reset pin on the motherboard and there isn't any way for software to intercept it. If there were, it wouldn't be much use as a reset button because those software processes would get stuck along with everything else when Windows hangs.

The simplest hardware fix is to unplug the reset switch from the motherboard altogether. This isn't as drastic as it sounds – you can still hold the power button down for three seconds to perform a hard shutdown when Windows crashes. But it's a little inelegant. Our preferred solution would be to fit a new reset button. You can buy quite nice case power switches with LED rings with a bit of hunting (Lamptron is the brand to search for). Mount one of these somewhere out of harm's way and leave the panel switch disconnected.

Luis Villazon

HARDWARE

HUMPTY 4TB SAT ON THE WALL

I have an external 4TB drive that I use as my backup. It recently took a hard tumble off the desk. As a precaution, I ran 'chkdsk' on it — that was over a week ago and it's still running. The screen shows that it has scanned about 14,000 files but the progress bar is completely empty. Is it safe to reboot in the middle of running chkdsk? How much longer should I leave it?

Tim Neil

External hard drives can take a little bit of rough and tumble, but serious knocks should always prompt a data check.

My hard rule is any operation that takes longer than 24 hours without giving any status updates is stuck. Rebooting in the middle of chkdsk isn't great, but either is leaving it forever. This is your backup drive, which means two things: none of the data is irreplaceable; and every day it's down, you aren't protected by a backup.

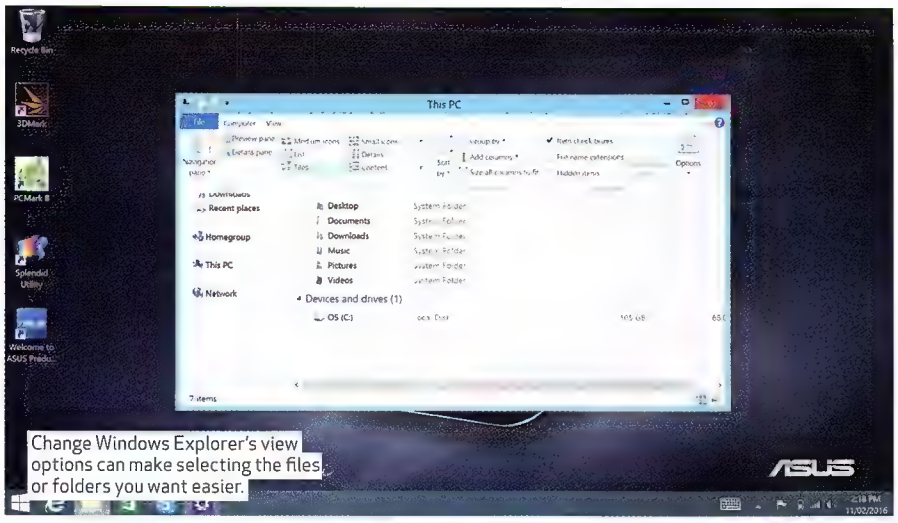
Reboot the PC and reformat the disk, then run a full backup. Finally, run chkdsk to verify the drive. If it passes, you can continue to use it, albeit with a degree of suspicion. But if chkdsk hangs again or you get any errors, order a replacement drive immediately and transfer your backup to that as soon as it arrives. Hard disks are like dogs; once they bite you, you can't truly trust them again.

Luis Villazon

WINDOWS

SELECTING FOLDERS

I need to copy lots of folders from a backup disk to an archive disk. I just want to copy the folders in the root directory (and all their subfolders) but not the loose files. The problem is there are hundreds and manually selecting them is very time



Change Windows Explorer's view options can make selecting the files or folders you want easier.

It's cheaper to get a new display than buy a new laptop. Usually.

consuming. At the moment, I have to hold Control and manually click each folder. This frequently results in my clicking the wrong thing or double-clicking and opening the subfolder. Is there an easy way to just select the folders? I'm using Windows 8.
Anne Balfour

Yes, this is actually quite easy. In Explorer, click 'View > Details' to display one item per line and then click the 'Type' column header to sort by type. This will lump all the folders together. You can just click the first one on the list, scroll to the bottom, press Shift and click the last one. Bingo bongo, all selected.

Or, if you want a slightly more old-school way, you could open the command prompt and type, 'for /D %d in (*) do xcopy /S /I %d D:\%d'. Make sure you begin at the root directory of the backup disk and replace 'D:' with the drive letter of the archive disk. The '/D' switch makes the '*' wildcard only match folder names, and the '/I' switch makes sure that the 'xcopy' command creates folders on the destination disk, as required.

What's the advantage with this method over just dragging and dropping in Explorer? You can put it in a batch file, if it's something you do often, I suppose. But mainly, it just makes you look like a pro hacker from the movies (where no-one ever does anything with a mouse).
Luis Villazon

HARDWARE

LAPTOP SCREEN ISSUES

My Windows laptop's screen has started flickering at random after three years, and my backlight doesn't appear to work — I keep having to increase the brightness. Can you suggest any fixes?
Jason Carney

There are three likely causes. The simplest is a driver or display calibration problem that can be fixed in Windows itself. Open Device Manager (press Windows-R, type in "devmgmt.msc" and hit Enter) to verify there are no driver issues — if a yellow exclamation mark is present next to either the Display Adapter or Monitor, you should double-click the entry to ascertain what the problem is; look for an updated driver from your laptop manufacturer or take a closer look at any error codes that are present along with any troubleshooting options offered. If your drivers check out, the next two options involve opening up your laptop, for which you'll need a service manual. Check with the laptop manufacturer or search Google for your laptop make and model and "service manual". If you can source one, check the cable connection between your screen and motherboard. This may have come loose — plugging it in securely should resolve the problem. If not, you may have to replace the laptop screen. Third-party screen-repair companies should usually charge around $200–$300 to replace a 15.6-inch display, but we'd suggest contact your laptop maker's support centre and checking prices and options through the official channels first.
Graham Barlow

"Third-party screen-repair companies should usually charge around $200–$300 to replace a 15.6-inch display."

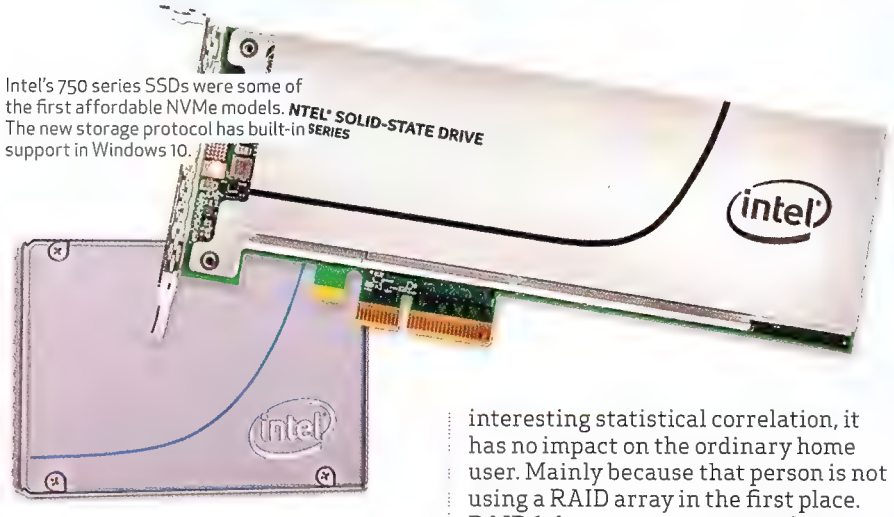
WINDOWS

MOVE WINDOWS TO A NEW PC

I previously bought a full version of Windows 8, and now wish to move it to a new PC. How do I achieve this? Do I need to de-authorise it on my old PC first?
George Bond

There's no de-authorising process in Windows. First, wipe Windows from your old PC, then install it onto your new one. When you come to activate it, it's probable the Internet option won't work, but a call to the number listed should get you up and running in about 10 minutes. When prompted, if the product is installed on more than one PC, say 'no', and in most cases, you'll complete activation automatically; otherwise, simply explain your situation to the person you speak to. Note, this process only works will full versions of Windows, not OEM or pre-installed versions — also, if you subsequently take advantage of the free upgrade to Windows 10, you won't be able to transfer that to a new PC.
Nick Peers

What are the chances of two drives failing at the same time? Quite high, surprisingly...



Intel's 750 series SSDs were some of the first affordable NVMe models. The new storage protocol has built-in support in Windows 10.

"Running one drive in for a few weeks won't help with that, any more than flipping a coin and getting 20 heads in a row increases the chance of getting tails next time."

HARDWARE
RAID USEFULNESS

Recently, the 2TB hard disk in my Windows desktop machine failed. I had a pair of them configured as a RAID 1 array, so I thought, "No problem — I can just switch them over and keep on trucking."

But then I discovered the other drive had failed as well! What are the odds of this? I've read online that drives of the same make and batch are more likely to fail at the same time. If this is true, should I run one of them on its own for a few weeks before setting up a new RAID 1 array, so the drives don't have the same amount of wear on them?

Daniel Croxford

I seem to remember there was a paper published years ago that found that drives in RAID arrays were more likely to fail close together than single drives in the same server. That's not altogether surprising.

The drives experienced exactly the same read/write activity and were more likely to be exactly the same make and model. But this is just an interesting statistical correlation, it has no impact on the ordinary home user. Mainly because that person is not using a RAID array in the first place. RAID 1 does not protect your data — it preserves your uptime. However many spare disks you have, you're better off using them as backup disks than configuring them as a RAID array. Backups will protect you from accidental deletion, driver installs that crash part way through installation, new versions of Windows that you decide you don't like, theft or flood damage of your PC, mains spikes, viruses and drive failure. RAID 1 will just protect you from a drive failure. And as you've discovered, not even always that.

Maybe both drives died because they both wore out at exactly the same moment, but it's pretty unlikely. More likely they were both killed by the same overheating problem or fluctuating mains voltage. Running one drive in for a few weeks won't help with that, any more than flipping a coin and getting 20 heads in a row increases the chance of getting tails next time.

Luis Villazon

WINDOWS
WINDOWS 10 UPGRADE

What's the best approach for upgrading a computer to Windows 10 and an NVMe-capable SSD? I want to retrofit my 4-year-old machine running Windows 7 Ultimate, an ASUS P8Z68 Deluxe, Core i5-2500K, Radeon HD 7900-series, 8GB of RAM, and Xonar Essence STX sound card.

If I update to Windows 10 now and then install the new SSD later, will I need to reinstall Windows 7 in order to get Windows 10 back, or is there another approach?

V Ryan

The good news: Windows 10 and NVMe-based SSDs work together just fine. If you update a retail copy of Windows 7 to Windows 10 now, it shouldn't be necessary to reinstall Windows 7 when you buy the SSD later (that may not be the case for OEM copies). What happens, in theory, is that your update is initially activated online with Microsoft. From there, you can use the media creation tool, producing a thumb drive or DVD with the install routine on it. When you go to reinstall Windows on the same machine that was originally upgraded, you're able to skip entering the product key. Windows will activate itself automatically online.

There may be a twist as you start swapping out hardware, though. Microsoft's original verbiage stated that significantly changing a hardware configuration would trigger a re-activation (similar to previous versions of Windows), and that this would nullify the free upgrade offer. It's now suggested that a retail copy of the operating system can be transferred to this "new" PC. In either case, you'd be entitled to keep Windows 10, though it might be easiest to upgrade after installing the SSD.

APC team

Programmatically responding to worksheet changes

Helen Bradley teaches how to make a macro run when the value in a cell on a worksheet changes.

Excel has built in event handlers that track how a user interacts with a worksheet. One of these, the Worksheet_Change event handler, fires when a change is made to a worksheet cell. You can use it to make calculations, to track when changes are made and even to undo unwanted changes. We'll show you how.

MAKING CALCULATIONS

To see how to use the Worksheet_Change event handler to make calculations, we'll create a simple conversion calculator. Start by typing the words 'Celsius' and 'Fahrenheit' into cells A1 and B1 of a new sheet. Type this into the code dialog for that sheet:

```
  Private Sub Worksheet_
Change(ByVal Target As Excel.
Range)
      If Target = Cells(2, 1)
Then
            Cells(2, 2) =
Cells(2, 1).Value * 9 / 5 + 32
      ElseIf Target = Cells(2,
2) Then
            Cells(2, 1) =
(Cells(2, 2).Value - 32) * 5 /
9
      End If
  End Sub
```

Now, when you type a value into cell A2 or B2, it will be converted to the other temperature scale and the result will appear in the appropriate cell in the sheet.

UNDO CHANGES

Another use for the Worksheet_Change event handler is to track and undo unwanted changes to data. This example undoes changes made to any cell in column B of the current sheet. To see it at work, type this into a sheet's code dialog:

```
  Private Sub Worksheet_
Change(ByVal Target As Range)
  If Target.Column = 2 Then
  Application.EnableEvents =
False
  Application.Undo
  Application.EnableEvents =
True
  End If
  End Sub
```

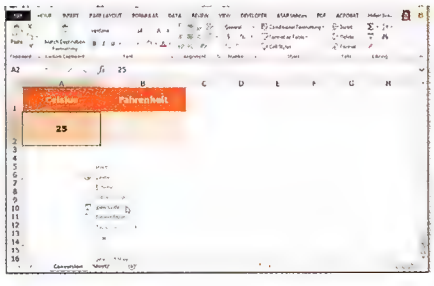
Now any changes to any cell in Column B will be automatically and immediately undone – the Application.Undo statement takes care of this. The Application.EnableEvents statement stops other events from firing while the code runs. This avoids an unwanted cascading effect where the macro itself would trigger the event handler to fire while the current code is still running. Make sure that, whenever you turn EnableEvents off in your code, you later turn it back on again – otherwise it will remain off.

You can also use the Worksheet_Change event handler to track when a worksheet was last updated. On a new sheet, enter this into the code dialog:

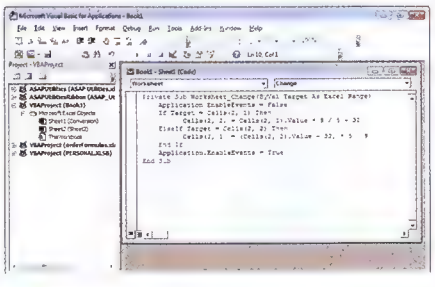
```
  Private Sub Worksheet_
Change(ByVal Target As Range)
  Application.EnableEvents =
False
  If Target.Column = 2 Then
            Range("A1").Value
= "Worksheet Last Changed: " &
Date
  ElseIf Target = Cells(1, 1)
Then
            Application.Undo
  End If
  Application.EnableEvents =
True
  End Sub
```

The date of any change to the worksheet is recorded in cell A1 and any attempts by the user to change that cell will be undone.

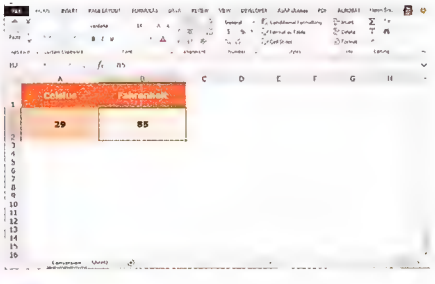
How to enter code into a sheet



STEP 1
To locate the code dialog for a sheet in a workbook, right click the sheet name and choose View Code.



STEP 2
Type the event handler code into the code window and choose 'File > Close and Return to Microsoft Excel' to return to your worksheet.



STEP 3
Test the code by entering a value into the current sheet. Each of these macros are limited in scope to the sheet that contains the code and they don't work with any other sheet.

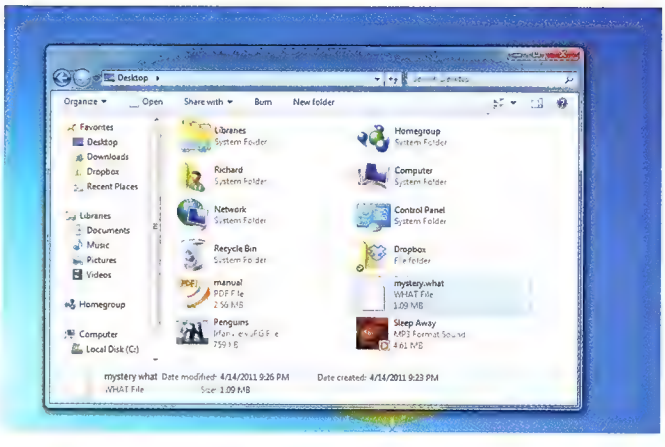
Teach Windows how to open files in the right apps

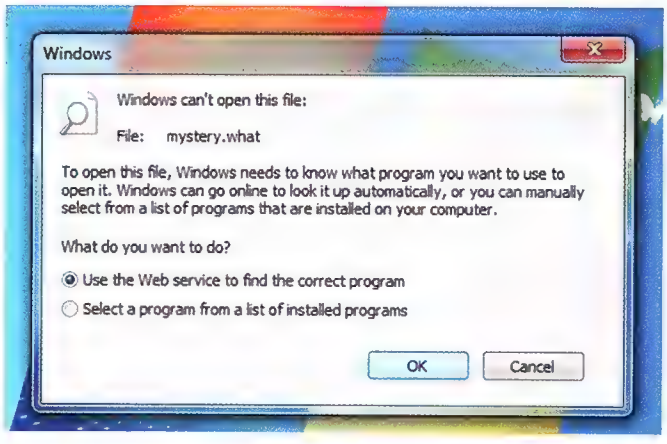
Richard Cobbet explains how to make sure Windows knows which programs you like to work in, and point it in the right direction.

File extensions don't just help you identify the contents of each file, they also tell Windows what to do when you double-click on them. It needs to know that a JPG file, for instance, is an image that you want to look at, and that an MP3 contains music that you want to play.

By default, Windows handles a wide assortment by itself, and is capable of performing a suitable action for each one. As you install more applications, however – each of which takes over certain file types and throws its own into the mix – things get more complicated. Take a ZIP archive, for instance. Double-clicking on one in Windows opens it like a folder, which is handy. Other archives, though, such as RAR, require separate applications. Do you prefer an easy exception, or consistency every time you open a file? With these tips, such questions will never pose a problem again.

Control your file extensions



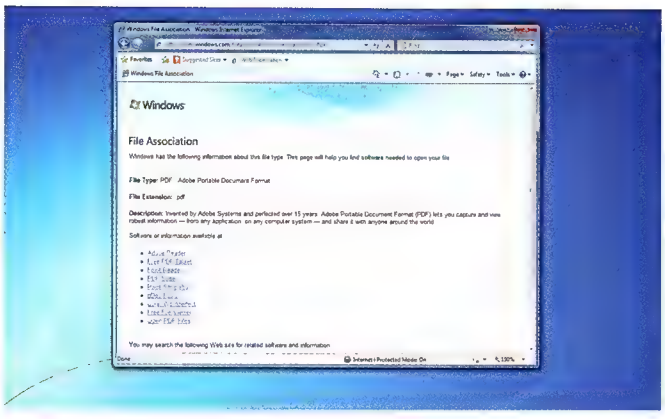

Windows
Windows can't open this file:
File: mystery.what
To open this file, Windows needs to know what program you want to use to open it. Windows can go online to look it up automatically, or you can manually select from a list of programs that are installed on your computer.
What do you want to do?
Use the Web service to find the correct program
Select a program from a list of installed programs
OK
Cancel

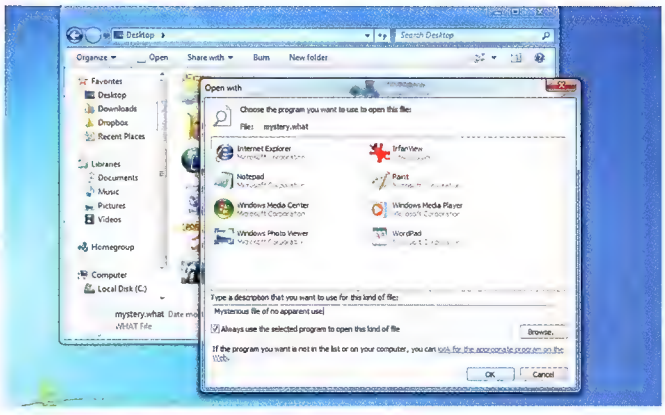
1 NEW ASSOCIATIONS

As a general rule, whenever you install new software, it automatically tells Windows which files it should deal with. These files are immediately shown using the appropriate icon (either the program's logo or a representation of what they contain, such as a picture or text). If a file isn't associated with a program or can't be identified, you see one of these blank icons instead.

2 SET ASSOCIATIONS

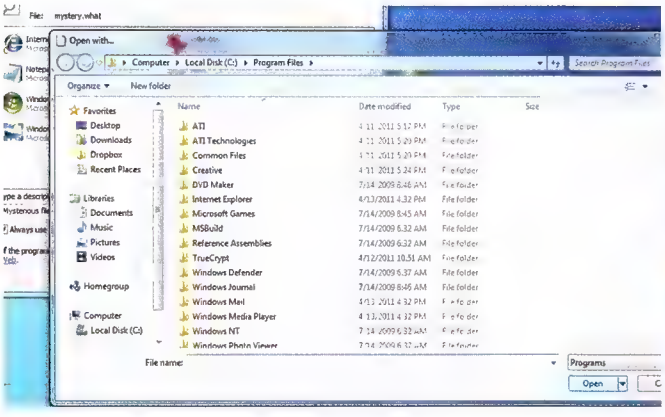
If you come across one of these blank icons, double-click it. The file won't open — instead, Windows will ask whether you want to go online to find out what it is and which programs are capable of opening it. This sounds good, but doesn't always work very well, so we don't recommend choosing this option for anything except well-known formats, such as PDF.





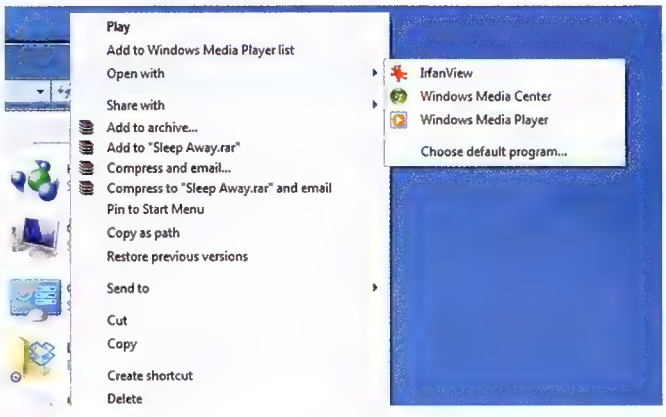
3 AUTOMATIC APPS

If you do select this option, you'll be shown a screen like this, listing various tools that might be able to read the file in question. This is purely a guess, though, based on the name. If multiple tools use the same extension, Windows can get confused and give you bad (though well-meaning) advice.



4 MANUAL SELECTION

The best approach is to choose 'Select a program from a list of installed programs'. This shows you every program you have installed on your computer. Select the correct one from the list, and click OK. Now, any time you double-click on this file type, Windows knows what to do.

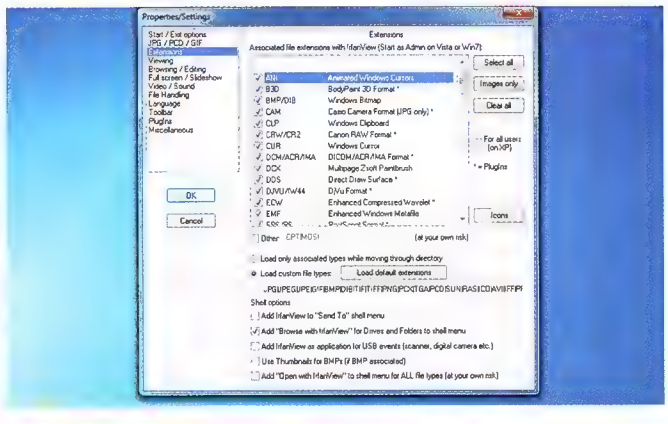


5 EXTRA APPS

If the application you want isn't on the list (for instance, if it was installed by simply copying files, instead of running a setup program), click Browse. This brings up an Explorer panel, which you can use to find it. Usually, the one you want is named: (name of application).exe.

6 CORRECTION

File types being assigned to the wrong application is annoying, but easily fixed. Find an example, hold down Shift and right-click on it. A new option called 'Open with' appears in the pop-up menu. Move the mouse over it and select 'Choose default program'. The window from the previous steps appears, and you can assign whatever application you like. This is especially helpful if a program you use gets grabby and tries to seize control of files you want handled separately.



7 ALWAYS OPEN

The File Associations window has an extra option called 'Always use the selected program to open this kind of file'. This is selected by default, but you might not always want to use it. Untick it and click OK, and the association becomes a one-time thing. This is handy if you need, say, one TXT file opened in Word rather than Notepad for its spell checker.

8 SEIZING CONTROL

Whenever you install a new application, especially something that handles media files, the first thing it often tries is taking over every file type it can possibly handle. This won't always be what you want, so it's best to work through the list of file associations and clip its wings unless you really don't mind. You now have the tools to do exactly that.

Tiled printing in OS X

Matthew JC. Powell explores ways to print big pictures on an A4 printer.

A printer is a terribly useful thing for the vast bulk of the stuff you need to print most of the time – letters, school assignments, forms and the like. But occasionally, you want (or need) to print something that exceeds the limitations of A4 paper – a poster or a banner – and it can be discouraging to see how much larger-format printing can cost from a bureau.

Hope is not lost, though, thanks to a process called tiled printing. What it essentially means is that the large thing you need to print is cut into smaller pieces ('tiles') that you print on A4 paper and then join together into a larger print. The result might not be art-gallery quality, but it's an inexpensive way to make a big colourful banner that reads "Happy retirement and good luck for the future, Bartholomew!" You could even add extra exclamation marks at the end. Luxury.

Back in the days of Classic Mac OS – before the X times – tiled printing was actually a standard feature of the Mac, provided your printer supported it (and most did). Nowadays, it isn't standard (though some applications like spreadsheets and CAD applications support it for their native file types). What's most galling is that, while many printer manufacturers support tiled printing in their driver software for Windows, few (if any) support it in their Mac versions.

Why, oh why?

There are, however, two ways to get tiled printing of literally any file you want on literally any printer you might happen to own with your Mac. One is free but a little fiddly, the other is cheap and simple.

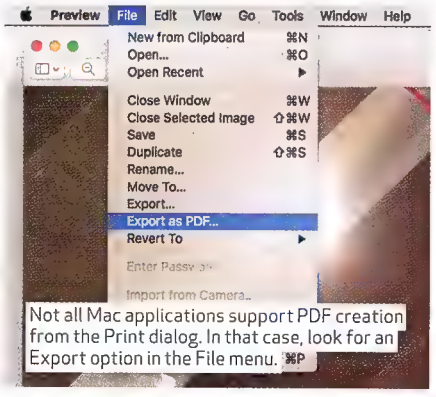
FIRST, LET'S TRY THE FREE ONE.

Adobe Acrobat Reader supports tiled printing on the Mac, and it is completely free. Acrobat Pro does as well, but it is pretty much the exact opposite of free.

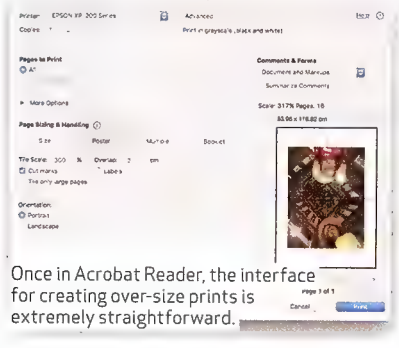
The limitation, of course, is that Acrobat Reader handles PDF files pretty much exclusively. So if you want to print a photo or a drawing you've created in some other application, you have to convert it to PDF first. Thankfully, creating PDFs is standard for pretty much any OS X application that can print.

In most applications, this is a simple matter of selecting 'File > Print' and then selecting the PDF option at the bottom left corner of the Print dialog. In other programs (for example Microsoft Word, Pixelmator or Apple's Keynote), you'll have to select 'File > Export...' and follow the prompts to save your file as a PDF. One notable exception is Apple's own Photos application, which doesn't appear to have the facility to create PDFs at the current version. If you want to create a PDF of an image from Photos, try opening it in Preview (another Apple application) first.

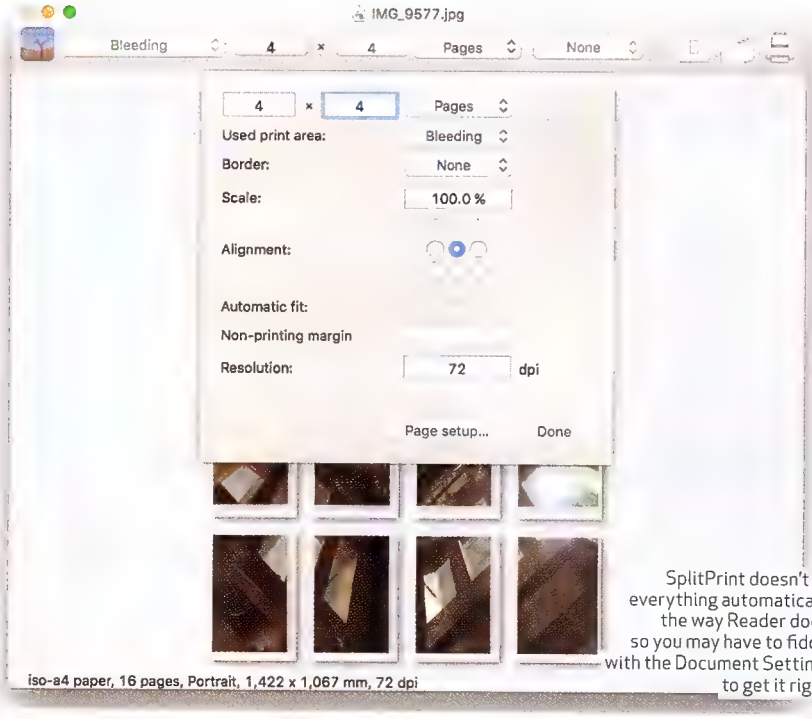
Once you have a PDF version of your file, open it in Adobe Acrobat Reader and select 'File > Print'. About halfway down the Print dialog box, you'll see a section called 'Page Sizing & Handling' and under that a button labelled 'Poster'. Click on Poster and you'll see options for creating a tiled print. Acrobat will automatically determine the number of tiles necessary for the page you're printing (though the display for this is a little confusing). You can scale up or down and it will recalculate the number of tiles accordingly. You also have the option to decide whether the tiles should overlap (that is, the edges of each tile will have the same content as the edges of the neighbouring



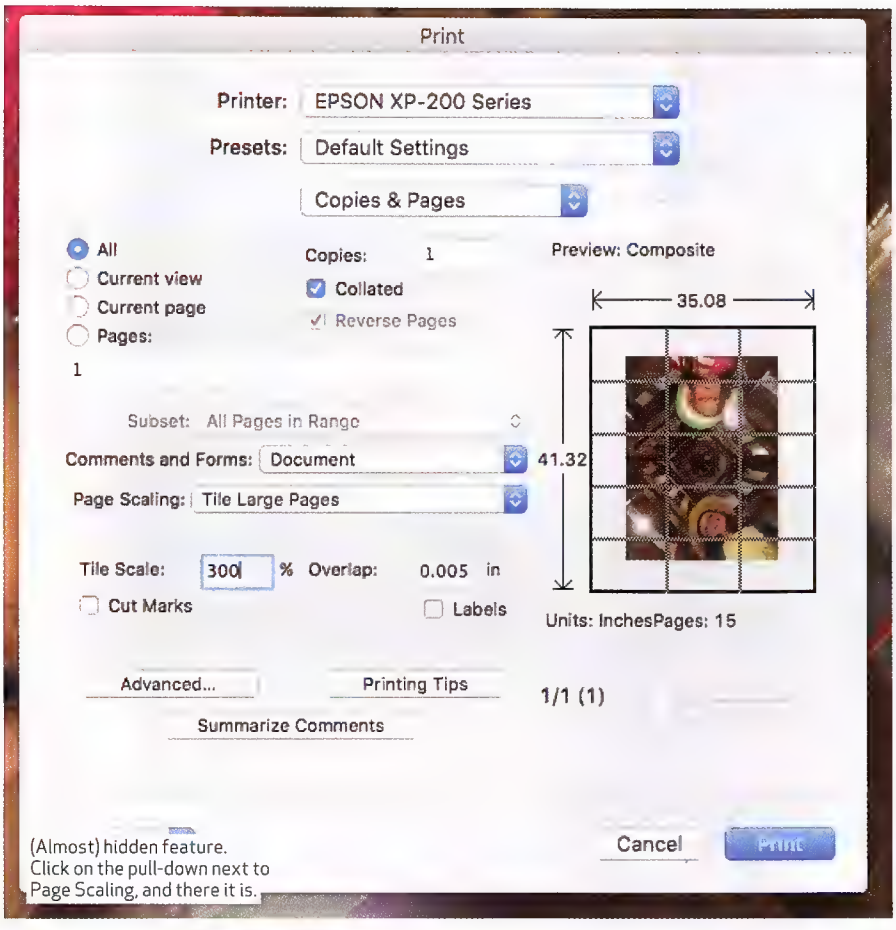
Not all Mac applications support PDF creation from the Print dialog. In that case, look for an Export option in the File menu. ⌘P



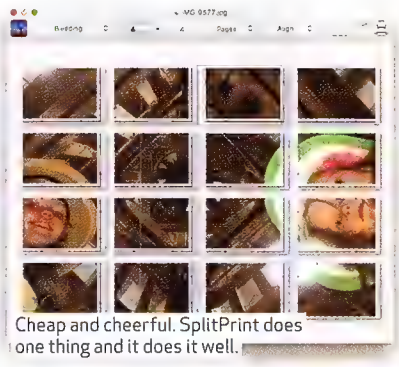
Once in Acrobat Reader, the interface for creating over-size prints is extremely straightforward.

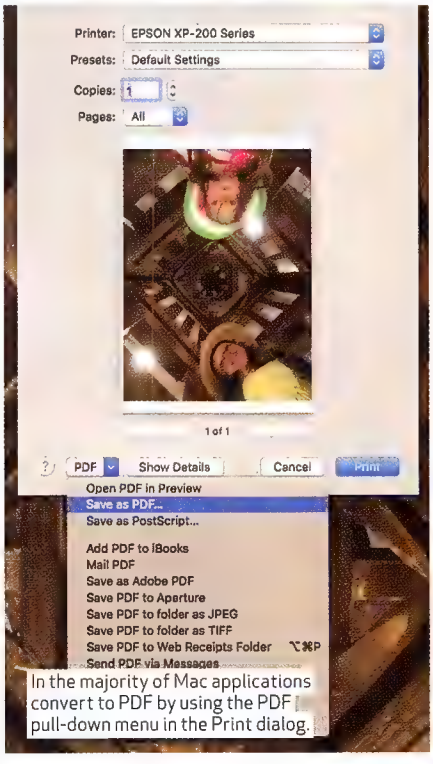


SplitPrint doesn't do everything automatically the way Reader does, so you may have to fiddle with the Document Settings to get it right.



(Almost) hidden feature. Click on the pull-down next to Page Scaling, and there it is.


Cheap and cheerful. SplitPrint does one thing and it does it well.



In the majority of Mac applications convert to PDF by using the PDF pull-down menu in the Print dialog.

> "The result might not be art-gallery quality, but it's an inexpensive way to make a big, colourful banner."

tiles) or whether you'll risk leaving gaps when you attach the tiles together. You can also have cut marks, which are useful both as guides for trimming the tiles and for helping align tiles.

Once you've chosen your options, simply click print and your tiles will start pouring out of your printer. Make sure you are well-stocked for ink.

NOW, THE CHEAP ONE...

Conversion to PDF isn't a particularly onerous task in OS X, but it's a task. And depending on the type of thing you're trying to print, there may be differences in the PDF version that you would avoid if you printed the file in its native format. If you want to avoid a step, print JPEGs or TIFFs or whatever directly, and are prepared to spend a few bucks, read on.

There are a number of apps on the App Store that offer the ability to produce over-sized prints, but the best balance of features and price is probably SplitPrint, by Dutch developer Ikka Virkunen.

At $9.99, it's unlikely to blow too large a hole in your budget, but it does offer a great deal of sophistication.

(There are some 'free' apps on the App Store that claim to offer this functionality, but some of them print with watermarks if you don't pay for the full version and others don't print at all – they exist just so you can see the features you would get if you buy the full version. SplitPrint deserves credit for being exactly what it says on the tin.

Once you've installed it, open up the image you wish to print. Like Acrobat Reader, SplitPrint will attempt to determine automatically how many tiles are required for your image. Unlike Acrobat Reader, it will sometimes guess incorrectly and will even scale your image to fit its guess. Thankfully, the application's entire user interface is basically a Print Preview, so you can see what you're going to get at a glance. Make sure that the dimensions and resolution along the bottom of the window are what you want before you click Print, to avoid wasting paper.

If need be, select 'View > Document Settings' (or click the icon that looks like a light switch in the toolbar) to ensure that you're printing at the magnification and resolution that you want. Any changes you make are reflected in real time, so it's easy to try a few things and see what effect each setting has.

When you're happy with your settings, click the printer icon in the upper right corner and away you go.

Finder File Edit View Go Window Help
Thu 08:47
Overview Displays Storage Memory Support Service
Macintosh FD
1.03 TB free of 1.04 TB
Other Apps Photos Audio Movies Backups
7.28 GB 2.42 GB 895.8 MB 82.2 MB 48.8 MB 7.6 MB
1.25 TB Fusion Drive
BOOTCAMP
199.48 GB free of 199.49 GB
Backups
7.6 MB
Disc formats that can be written:
CD-R, CD-RW, DVD-R, DVD+R, DVD-RW, DVD+RW, DVD-R DL, DVD+R DL
SuperDrive

Make your own Mac Fusion Drive

Alan Stonebridge teaches how to boost your Mac's responsiveness without compromising on disk capacity.

Apple's Fusion Drive technology is intended to bring the benefit of fast flash storage to desktop Macs in an economical way, and without compromising on the large storage capacity you would expect to be built into such a computer. Even now, more than three years since Fusion Drive's introduction, flash storage is disproportionately expensive per gigabyte compared to traditional hard drives.

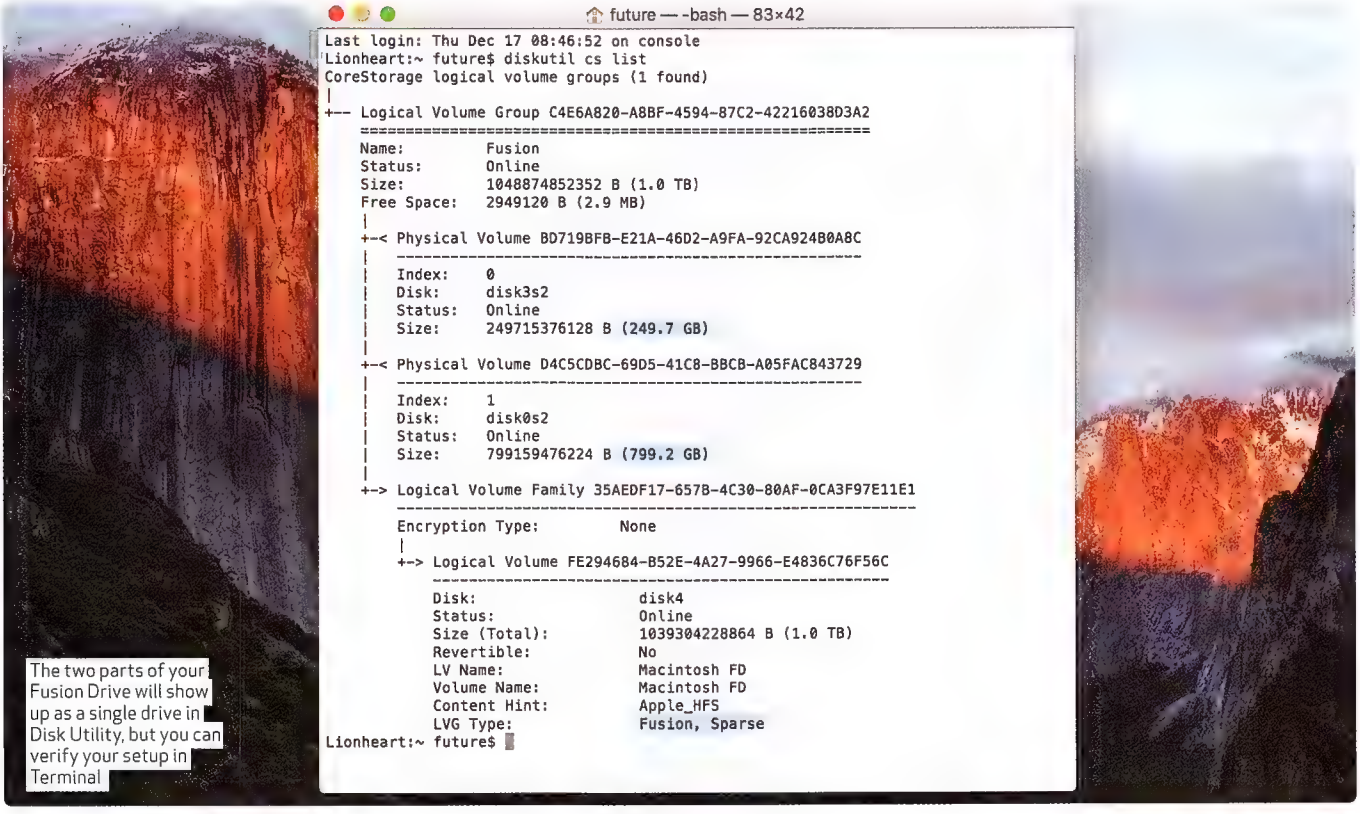
On the few iMacs on which Apple offers 1TB of its ultrafast PCIe storage as an option, that will add approximately $1,100 to your bill. In constrast, upgrading from the regular 1TB hard drive to a 1TB Fusion Drive can cost you as little as $160 extra.

If you've bought a desktop Mac in the last three years or so, you might have decided you could get by without a Fusion Drive to save yourself even comparatively modest extra expense. Your Mac may now be looking a little long in the tooth – particularly compared to modern MacBooks, all of which have flash storage – simply because you're having to wait for mechanical storage media to catch up with what you're asking the computer to do. Apple doesn't offer post-sales Fusion Drive upgrades. However, the USB 3.0 ports on recent Macs provide a cost-effective way to create your own Fusion Drive.

If you have enough spare cash to throw at upgrading your current Mac, you could just buy a 1TB solid-state drive to connect externally and run your computer from that. Although a 1TB bare SSD will cost you far less than what Apple charges for flash storage, it's still around $500. So we'll look at the more affordable option of making a home-made Fusion Drive for well under half that amount.

HOW DOES FUSION DRIVE WORK?

'Fusion Drive' is really just a friendly name for a technology called Core Storage – specifically, it's a Core Storage Logical Volume Group – which is available in OS X 10.8.2 or higher. As long as you're brave enough to enter



The two parts of your Fusion Drive will show up as a single drive in Disk Utility, but you can verify your setup in Terminal

a few commands in Terminal, you can 'fuse' your Mac's internal hard drive and an external SSD together so that their capacities are combined into what looks like one drive. The idea is that if you weren't aware of this going on behind the scenes, you would perceive it as a single drive that's both fast and capacious.

Behind the scenes, OS X is smart enough to recognise that one of the parts of a Fusion Drive is much faster than the other. Whenever new information needs to be written to a Fusion Drive, it's written to the faster storage as a matter of priority. This makes your Mac feel better to use than one that's equipped only with a plain old hard drive, even though that still makes up a large part of its storage.

When free flash storage falls to a certain amount – we're talking a few gigabytes – OS X uses its long-term assessment of what you use most often, whether that's your own files or apps (OS X remains on flash storage to aid its performance) to determine what it can relegate to the hard drive without affecting you much, if at all. A minimum amount of free space is maintained on the flash storage so that the operating system always has space to store information in a hurry.

If you use something from the hard drive enough, OS X will recognise that and move something else to the slower storage, and move the information you're actually using a lot back to the faster storage medium. For efficiency, OS X doesn't necessarily move entire files between a Fusion Drive's two parts. Instead, it works at a lower level to move only what is necessary.

SENSIBLE PRECAUTIONS

Before we get down to work, back up all of your hard drive's current contents. Setting up a Fusion Drive requires temporarily erasing it, so save yourself unnecessary hassle by making a complete backup of it. You'll be able to restore this to the Fusion Drive later. Time Machine is the simplest way to do this, of course. In its preferences, ensure no system folders or others containing important personal files are excluded from its backups. Next, click Time Machine's status icon in the menu bar – turn this on in its preferences if you don't see it – and choose the Back Up Now option. While that process takes place, you can prepare some other essentials.

The image above shows the three things you need. If you already have a spare 8GB USB flash drive, you'll only need to buy an SSD and an enclosure to put it in (our recommended model to the right even includes a USB cable). The USB flash drive – that's the thumb drive, not the SSD – only needs to be 8GB as that's all that's required to store the OS X installer.

Originally, Apple's Fusion Drives included 128GB of flash storage (recently reduced to 24GB on 1TB models). However, the difference in price between a 120GB and a 250GB SSD is only about $40 or so. Doubling up means more information can be kept on the faster storage medium at any one time, delaying the need for OS

You can set up a Fusion Drive without affecting Boot Camp, but it's sensible to back up both OS X and Windows anyway.

The hardware you'll need:

1 8GB USB FLASH DRIVE
Ideally, use a drive of at least this capacity as that's all you need to make an OS X install disk.

2 2.5-INCH SSD
Apple's Fusion Drives contain either 24GB or a 128GB of flash storage; a 250GB SSD costs little extra.

3 USB 3.0 HARD DRIVE ENCLOSURE
You'll need a drive enclosure to store the SSD, and to connect it to your Mac.

4 A MAC WITH USB 3.0 PORTS
USB 2.0's slower transfer rates will negate the point of building a Fusion Drive.

X to shift data to the hard drive at all.

LAY THE GROUNDWORK

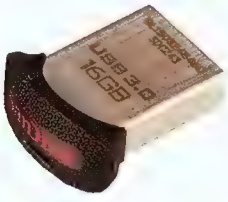
Disconnect all other external storage from your Mac so you don't accidentally erase an incorrect drive. Now, connect the USB flash drive to your Mac and ensure it doesn't contain anything you want to keep. Open Disk Utility, select the flash drive – not the partition on it – and then click the Erase button on the toolbar. Give it a format of OS X Extended (Journaled), and set its partition map type to GUID so your Mac can start up from it. Download the installer for your version of OS X from the Mac App Store. It needs to be OS X 10.8.2 or higher. When it's downloaded, use it to create an OS X install disk. For OS X 10.9 or higher, follow Apple's instructions at **http://bit.ly/osxinstalldisk**. For OS X 10.8 (Mountain Lion), hold Control and click the installer, choose Show Package Contents, browse to Contents › SharedSupport and double-click InstallESD.dmg there. Open Disk Utility, click the Restore tab, drag 'Mac OS X Install ESD' from the left pane into the Source box, and the partition on the USB flash drive into the Destination box. Click the Restore button and, if asked, enter your account credentials. It takes a while for the OS X installer to be copied to the flash drive. With your OS X install disk prepared, restart your Mac and hold down Option from the moment you hear the startup sound until you see a list of partitions that your Mac can start up from. Among them, you should see the install disk you just created. Use the arrow keys to select it, press Return and then wait. You'll eventually reach a menu with four major options. Ignore that and choose Utilities › Terminal. We're now ready to build your Fusion Drive.

Best Buys!

This is the hardware we used to create our own Fusion Drive. You might be able to save a few extra dollars on the SSD's price by picking a different brand or capacity, but our pick is a good deal overall.

SANDISK CRUZER FIT

Any USB 2.0 or 3.0 flash drive can be used to create an OS X install disc. Its capacity only needs to be 8GB; this one costs around $10.

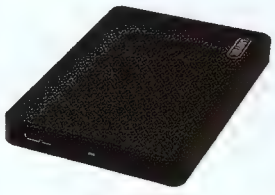


SAMSUNG 850 EVO

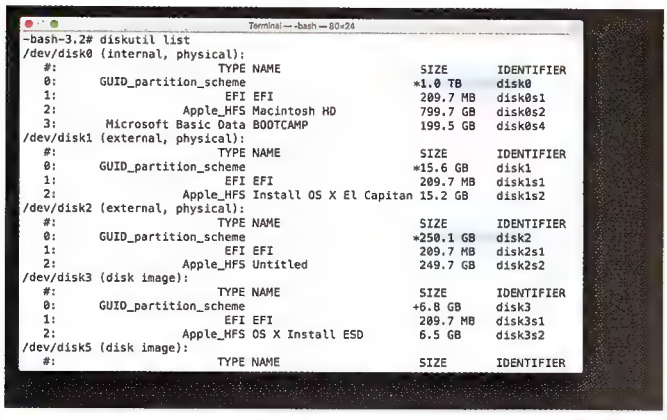
The 250GB version of this drive sells for just $135. That's almost double the flash storage capacity used in Apple's largest Fusion Drives!

UNITEK Y-3257

This USB 3.0 enclosure is plastic, yet requires no tools to open and fit an SSD. For around $15, it includes a USB cable.

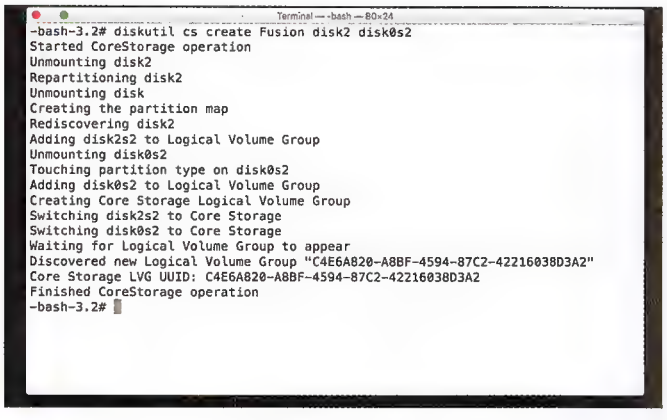


How to: Set up your Fusion Drive


Terminal — -bash — 80×24
-bash-3.2# diskutil list
/dev/disk0 (internal, physical):
#: TYPE NAME SIZE IDENTIFIER
0: GUID_partition_scheme *1.0 TB disk0
1: EFI EFI 209.7 MB disk0s1
2: Apple_HFS Macintosh HD 799.7 GB disk0s2
3: Microsoft Basic Data BOOTCAMP 199.5 GB disk0s4
/dev/disk1 (external, physical):
#: TYPE NAME SIZE IDENTIFIER
0: GUID_partition_scheme *15.6 GB disk1
1: EFI EFI 209.7 MB disk1s1
2: Apple_HFS Install OS X El Capitan 15.2 GB disk1s2
/dev/disk2 (external, physical):
#: TYPE NAME SIZE IDENTIFIER
0: GUID_partition_scheme *250.1 GB disk2
1: EFI EFI 209.7 MB disk2s1
2: Apple_HFS Untitled 249.7 GB disk2s2
/dev/disk3 (disk image):
#: TYPE NAME SIZE IDENTIFIER
0: GUID_partition_scheme +6.8 GB disk3
1: EFI EFI 209.7 MB disk3s1
2: Apple_HFS OS X Install ESD 6.5 GB disk3s2
/dev/disk5 (disk image):
#: TYPE NAME SIZE IDENTIFIER

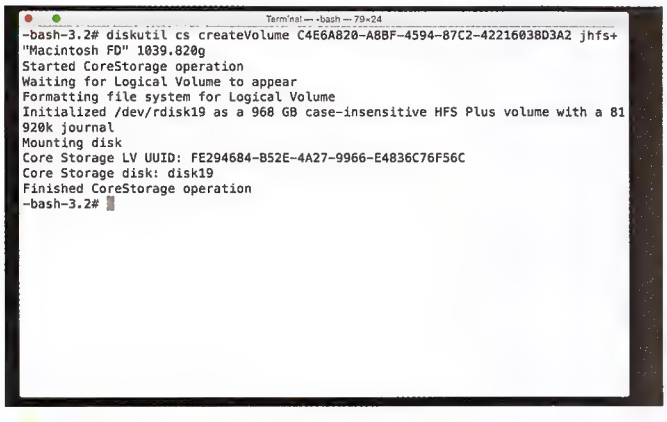
1 GATHER SOME INFORMATION

In Terminal, type `diskutil list` and press Return to list partitions, which are grouped by the disk, under rows starting /dev/diskX (where X is a number). Two rows below those ones, use the Size column to work out which disk identifiers refer to your internal hard drive and your SSD.


Terminal — -bash — 80×24
-bash-3.2# diskutil cs create Fusion disk2 disk0s2
Started CoreStorage operation
Unmounting disk2
Repartitioning disk2
Unmounting disk
Creating the partition map
Rediscovering disk2
Adding disk2s2 to Logical Volume Group
Unmounting disk0s2
Touching partition type on disk0s2
Adding disk0s2 to Logical Volume Group
Creating Core Storage Logical Volume Group
Switching disk2s2 to Core Storage
Switching disk0s2 to Core Storage
Waiting for Logical Volume Group to appear
Discovered new Logical Volume Group "C4E6A820-A8BF-4594-87C2-42216038D3A2"
Core Storage LVG UUID: C4E6A820-A8BF-4594-87C2-42216038D3A2
Finished CoreStorage operation
-bash-3.2#

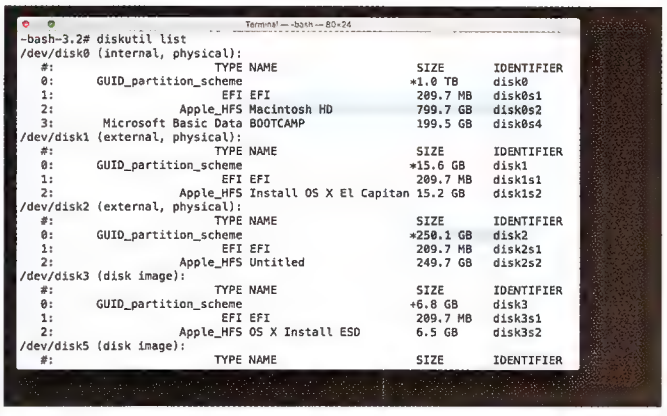
3 PREP A LOGICAL VOLUME GROUP

Type `diskutil cs create Fusion` followed by a space, then the identifier of your SSD, another space, then the identifier of your OS X volume. Press Return to create a logical volume group that identifies the storage that will be used by the Fusion Drive.


Terminal — -bash — 79×24
-bash-3.2# diskutil cs createVolume C4E6A820-A8BF-4594-87C2-42216038D3A2 jhfs+
"Macintosh FD" 1039.820g
Started CoreStorage operation
Waiting for Logical Volume to appear
Formatting file system for Logical Volume
Initialized /dev/rdisk19 as a 968 GB case-insensitive HFS Plus volume with a 81
920k journal
Mounting disk
Core Storage LV UUID: FE294684-B52E-4A27-9966-E4836C76F56C
Core Storage disk: disk19
Finished CoreStorage operation
-bash-3.2#

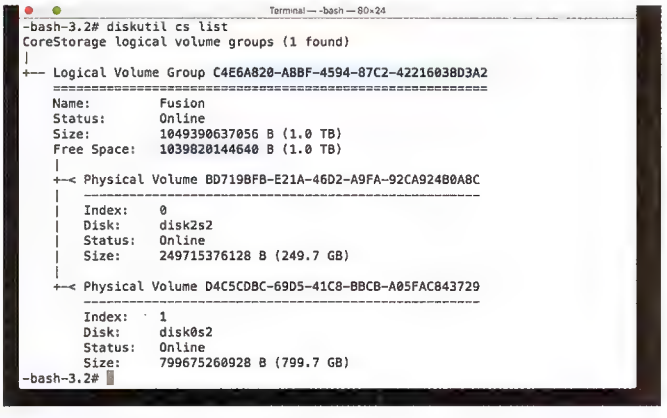
5 PREPARE A VOLUME

Type `diskutil cs createVolume`, a space, then press Control-V to paste the code you copied. Type another space, then `jhfs+ "Macintosh FD"` and a space. Divide the capacity you noted by 1,000 three types and type the result (we've done so to three decimal places) — and then `g`.


Terminal — -bash — 80×24
-bash-3.2# diskutil list
/dev/disk0 (internal, physical):
#: TYPE NAME SIZE IDENTIFIER
0: GUID_partition_scheme *1.0 TB disk0
1: EFI EFI 209.7 MB disk0s1
2: Apple_HFS Macintosh HD 799.7 GB disk0s2
3: Microsoft Basic Data BOOTCAMP 199.5 GB disk0s4
/dev/disk1 (external, physical):
#: TYPE NAME SIZE IDENTIFIER
0: GUID_partition_scheme *15.6 GB disk1
1: EFI EFI 209.7 MB disk1s1
2: Apple_HFS Install OS X El Capitan 15.2 GB disk1s2
/dev/disk2 (external, physical):
#: TYPE NAME SIZE IDENTIFIER
0: GUID_partition_scheme *250.1 GB disk2
1: EFI EFI 209.7 MB disk2s1
2: Apple_HFS Untitled 249.7 GB disk2s2
/dev/disk3 (disk image):
#: TYPE NAME SIZE IDENTIFIER
0: GUID_partition_scheme +6.8 GB disk3
1: EFI EFI 209.7 MB disk3s1
2: Apple_HFS OS X Install ESD 6.5 GB disk3s2
/dev/disk5 (disk image):
#: TYPE NAME SIZE IDENTIFIER

2 PROTECT OTHER PARTITIONS

To avoid wiping the partition that contains the Recovery system and, if it exists, one for Boot Camp as well, examine the output for a row that contains the name of the partition that contains OS X. Note its identifier to the right, which will be in the format diskXsY.



4 GATHER MORE INFORMATION

Type `diskutil cs list` and press Return for a summary of what was created. In the row that starts '+-- Logical Volume Group', drag the pointer through the long alphanumeric code to select it, then press Control-C. Make a note of the free space listed below that.

6 FINISH UP AND RESTORE DATA

Press Return to make the volume. When done, look for a line that says 'Finished CoreStorage operation'. Quit Terminal. Your Fusion Drive, named Macintosh FD (or whatever you want to rename it), is waiting for you to install a fresh copy of OS X or restore your backup to it.

Encrypt drives in Linux

Insulate your data another way, Mayank Sharma shows you how.

While you can control access to the data on your computer using user accounts and file permissions, they aren't enough to prevent a determined intruder from gaining access to your private files. The only reliable way to keep your personal data to yourself is to use encryption. Sure, working with encrypted data is an involved process, but it'll go a long way in reinforcing your security and insulating your data. ZuluCrypt is a graphical encryption application that has an intuitive and easy-to-follow interface. Using the application, you can create an encrypted disk within a file, a partition and even USB disks. It can also be used to encrypt individual files with GPG.

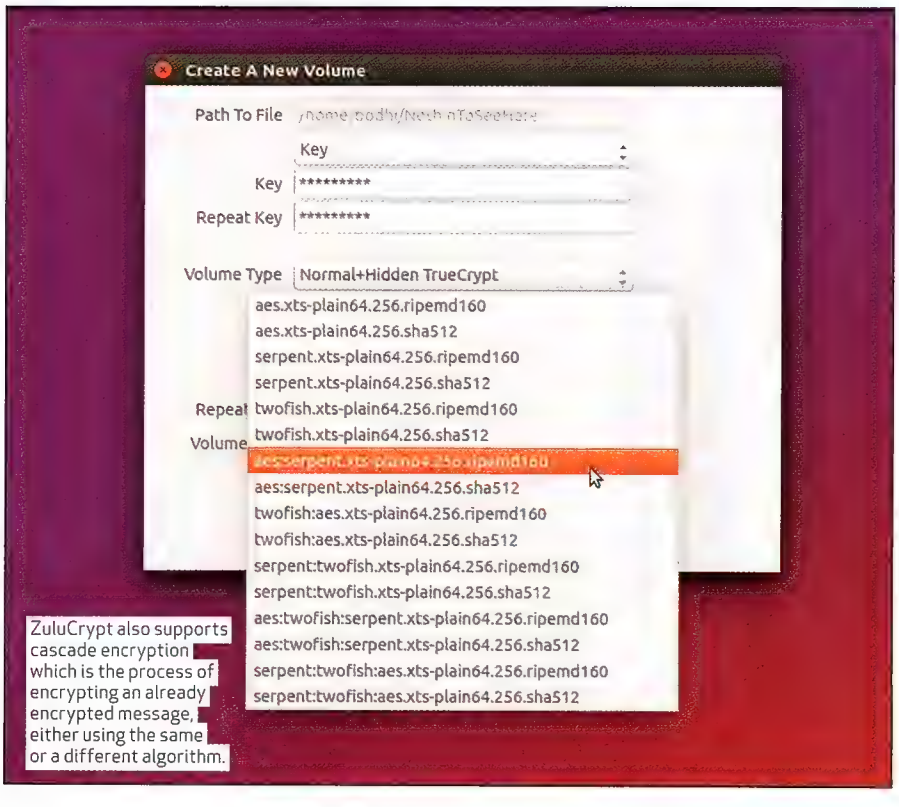
To install ZuluCrypt, head to **mhogomchungu.github.io/zuluCrypt** and scroll down the page to the binary packages section. The applcation is available as installable Deb package files for Debian and Ubuntu. Download the package for your distro and extract it with `tar xf zuluCrypt*.tar.xz`

Inside the extracted folder, switch to the folder corresponding to your architecture ('i386' for older 32-bit machines and 'amd64' for new 64-bit ones). Both folders contain four binary packages that you can install in one go with the `sudo dpkg -i *deb` command. On other distros, you will have to install ZuluCrypt manually. Download the application's tarball and follow the detailed steps in the included build-instructions file to fetch the dependencies from your distro's repos.

One of the first things you should do after installing is to create encrypted versions of all files that you consider sensitive. Fire up the application and head to 'zC > Encrypt A File'. In the dialog box that comes up, press on the button adjacent to the Source field and navigate to the file you wish to encrypt. ZuluCrypt will use this information to create a file with the same name and append the zC extension at the end – or save it elsewhere by clicking on the folder icon adjacent to the Destination field and navigating to a new location.

Next, enter the password for encrypting the file in the key field. Make sure the password is a mix of characters and numbers to make it difficult to guess. Also remember that there's no means of recovering the password if you ever forget it, and no possibility of decrypting the file – that's sort of the point! Once you've confirmed the password, press the 'Create' button to encrypt the file. This process might take some time depending on the type and size of the file you are encrypting. Once it's done, you'll have the encrypted version with the .zC extension in the destination location you specified earlier. Once a file has been encrypted, make sure you delete its original version.

You'll now have to decrypt the file before you can read and make changes. For this, launch ZuluCrypt and head to 'zC > Decrypt A File'. Point to the encrypted file in the Source field and alter the location of the unlocked file in the Destination field. Now enter the password with which you encrypted the file and click the 'Create' button. When it's done, the decrypted file will be created in the specified destination. To lock the file again, encrypt it by following the previously outlined procedure.



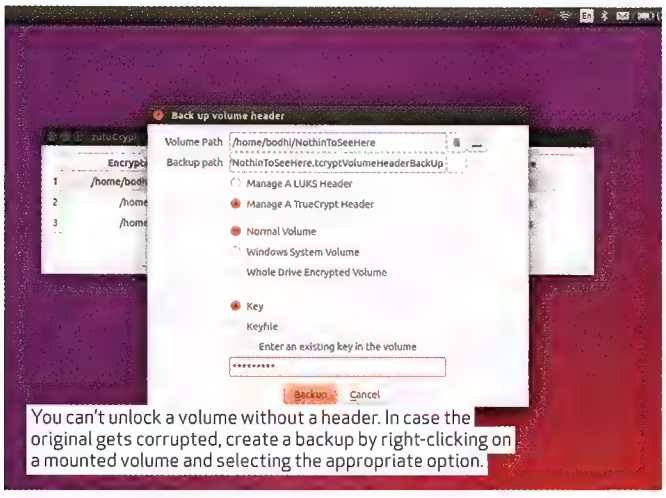
ZuluCrypt also supports cascade encryption which is the process of encrypting an already encrypted message, either using the same or a different algorithm.

ENCRYPTED DATA SILOS

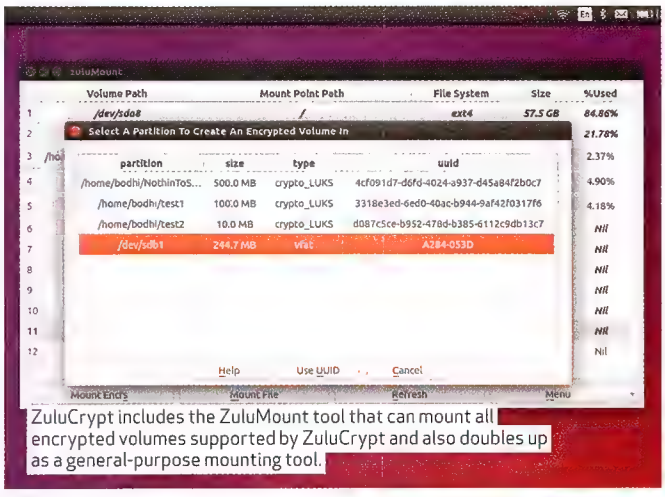
Individually encrypting files works adequately if you only need to protect a couple of files. Generally, it's a cumbersome process and is only suitable for files you don't need to read or modify regularly. If you need to protect a number of files that you access frequently, a better approach is to file them inside encrypted storage areas.

ZuluCrypt can perform block device encryption, which means that it can encrypt everything written to a certain block device. The block device can be a whole disk, a partition or even a file mounted as a loopback device. With block device encryption, the user creates the file system on the block device, and the encryption layer transparently encrypts the data before writing it to the actual lower block device. While encrypted, the storage area just appears like a large blob of random data and doesn't even reveal its directory structure.

To create an encrypted storage device within a file, fire up ZuluCrypt and head to 'Create > Encrypted Container In A File'. In the window that pops up, you'll have to enter the name and complete path of the directory under which you'll house your sensitive data. It's called a file, because it'll appear as a singular file when it's encrypted. You'll also have to specify



You can't unlock a volume without a header. In case the original gets corrupted, create a backup by right-clicking on a mounted volume and selecting the appropriate option.



ZuluCrypt includes the ZuluMount tool that can mount all encrypted volumes supported by ZuluCrypt and also doubles up as a general-purpose mounting tool.

the size of the directory depending on the size of the files it'll house and the space available on your disk.

When you press the 'Create' button, ZuluCrypt pops up another window. First up, you'll have to specify a password for encrypting the file. Next, you'll have to select a Volume Type. The default option is LUKS, or Linux Unified Key Setup, which is a disk-encryption specification designed specifically for Linux. In addition to LUKS, ZuluCrypt can also create and open TrueCrypt, VeraCrypt and Plain volumes. Plain volumes are headerless encrypted volumes and the encryption information is provided by ZuluCrypt. Because of this, Plain volumes are application-dependant and not very portable. TrueCrypt or VeraCrypt volumes are better alternatives if the encrypted volume is to be shared between Linux, Windows and OS X computers.

Once you've decided on the type of Volume, you'll have to pick a cipher, an algorithm that does the actual encryption and decryption. An associated attribute of the cipher is the associated size of the key. As the key size increases, so does the complexity of exhaustive search to the point where it becomes impracticable to crack the encryption directly.

The most popular encryption cipher is the Advanced Encryption Standard (AES) which is based on the Rijndael cipher. AES with a key size of 256 bits is widely used as it offers the right balance of speed and security. This is the default cipher in ZuluCrypt. However, the application supports a large number ciphers including the Twofish algorithm and Serpent. These two are considered by the US National Institute of Standards and Technology to have a higher security tolerance than AES, but are also slower.

You can safely select the default values for each field, including the default filesystem for the volume (ext4) and press the 'Create' button. When the process completes, you'll notice a file with the name you specified for the encrypted container with illegible content and size equivalent to what you specified earlier.

Before you can store files inside this encrypted volume, you'll first have to decrypt and mount it. Head to 'Open > PLAIN,LUKS,TrueCrypt Container In A File'. Use the file button in the pop-up window to navigate to the encrypted container file that you've just created. If you wish, you can alter the mount name for the file, else just enter the password and press 'Open'. Toggle the checkbox if you only want to read the contents of encrypted volume.

Once your volume is mounted, it'll appear in your file system like any other mounted file system. The main ZuluCrypt window will also list the volume along with the complete mount path. You can now create directories within this mounted location and create files just like you would on any regular mounted device. When you're done, right-click on the mounted volume in the ZuluCrypt interface and select the 'Close' option. This will unmount and encrypt the volume and all you'll have, once again, is the single encrypted file with illegible content. Mount the file again following the procedure mentioned above to reveal its contents.

If you have issues managing multiple passwords, ZuluCrypt gives you the option to create random keyfiles which you can then use to encrypt files and volumes. To generate a keyfile head to 'Create > Keyfile'. Now enter the name for the keyfile and its storage path. From a security point of view, you should make sure the keyfiles are not stored on the same hard disk as the files or volumes it encrypts. In fact, it's best to keep these on an external drive which ensures that your encrypted data remains secure, even if someone grabs hold of your drive containing the encrypted files and volumes.

To use a keyfile instead of a password, select the keyfile option using the drop-down menu when creating an encrypted volume or encrypting a file. After selecting this option, you'll also have to point the application to the keyfile, which will then be used to lock your data.

SCRAMBLE PARTITIONS AND DISKS

If you want to encrypt large amounts of data, it's best to place the encrypted container inside a partition of its own or even on a removable USB drive. Note that when you create such a container, ZuluCrypt takes over the entire partition or disk, so make sure you've backed up any existing data.

Also, make sure that the destination partition or drive isn't mounted. Use the `mount` command to list all mounted partitions. If the partition you wish to use, say `/dev/sdb1`, is mounted, you'll first have to unmount it with `sudo umount /dev/sdb1`. Now launch ZuluCrypt and head to 'Create > Encrypted Container In A Hard Drive'. In the window that pops up, ZuluCrypt will list all the available partitions that it can use to house the encrypted volume. Note that the devices are listed both by device name and by the associated UUID. If you are creating a container on a removable disk, make sure you toggle the 'Use UUID' option. This will ensure that ZuluCrypt always correctly identifies the device. Now double-click on the drive/partition you wish to create the volume on. You can now create an encrypted volume on the drive using the same exact procedure we used earlier to create an encrypted volume inside a file.

Although, at first, it might sound cumbersome to use, over time ZuluCrypt will grow on you as you get familiar with the application. There's no easier way for the privacy conscious to keep their data secure.

Borrow library ebooks on iOS

Cliff Joseph shows how OverDrive brings you ebooks and audiobooks from your local library.

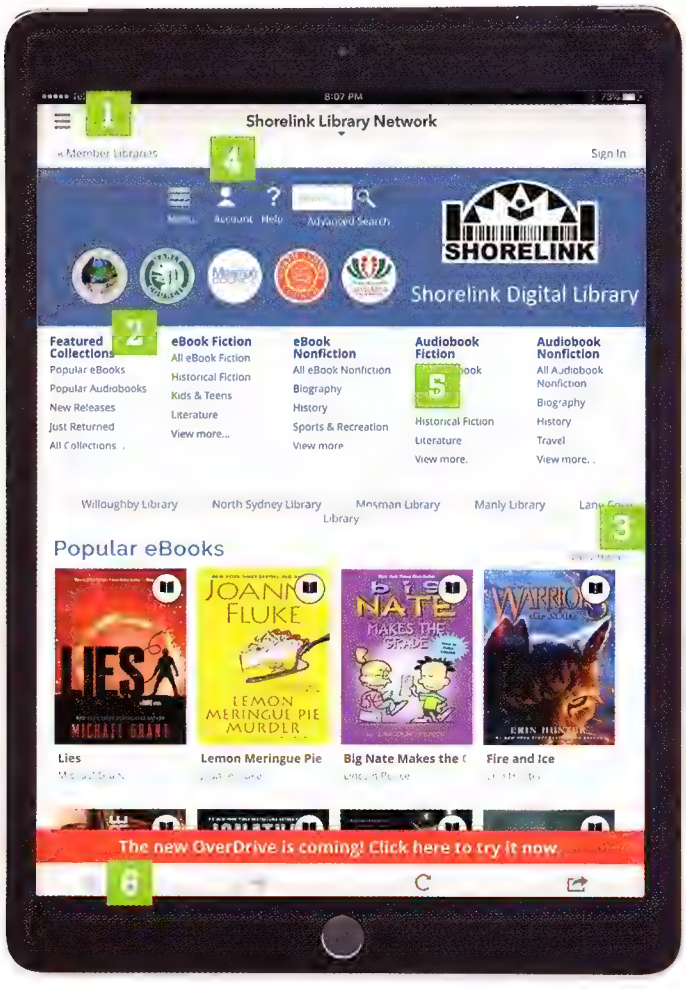
OverDrive doesn't get a lot of attention, but it's a must-have app for pretty much anyone who has ever picked up a book. It takes a few minutes to get it set up properly, but it's well worth the effort, as this hidden gem of an app allows you to borrow free ebooks and audiobooks from your local library.

OverDrive is free to download from the App Store, and there's no charge for borrowing books – you don't even have to worry about paying a fine for overdue books as the app automatically deletes your books at the end of the loan period.

The screen size of an iPad or iPad mini is ideal for reading ebooks that you download with OverDrive, and it can also be used to listen to audioooks on an iPhone while travelling. There's an OverDrive app for Macs too, which can come in handy for students or teachers who need to do a bit of research in the classroom. The only catch is that you need to be a member of your local library in order to use it.

Visual Guide: OverDrive Online Library

Browse and borrow books from your local library without getting off the sofa.



1 OVERDRIVE OPTIONS

The Menu button allows you to control a number of options, such as the ability to sync books across devices. You can also limit downloads to Wi-Fi only, to preserve your monthly data allowance.

2 BROWSING BOOKS

This menu allows you to browse books by category, such as romance, fantasy or thriller. There's also a search tool that allows you to search by title or the author's name. Most libraries have a good selection of non-fiction books too.

3 WISH LIST

Your library has a limited number of copies of each ebook. If this book icon is black, the book is available to borrow now. A grey icon means all copies are currently on loan. OverDrive will email you when the book is available.

4 LENDING LIMITS

Your OverDrive account follows your library's normal lending policies. *APC*'s local library lets us borrow five books for 21 days each, and OverDrive automatically deletes books at the end of the loan period. You can also delete them yourself if you finish before then.

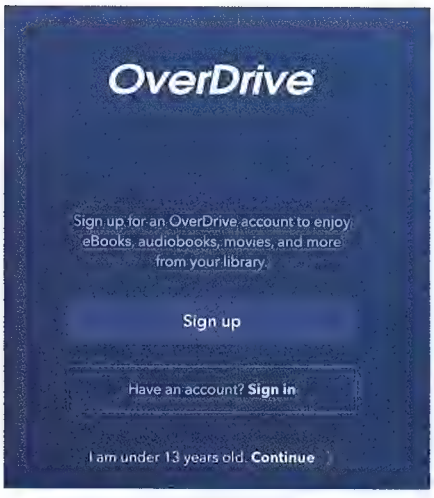
5 AUDIOBOOKS

Most local libraries will allow you to borrow audiobooks too. The audiobook controls in OverDrive include options such as a sleep-timer, so that you can listen to books in bed at night and leave the app to turn itself off after a specified amount of time.

6 TURNING PAGES

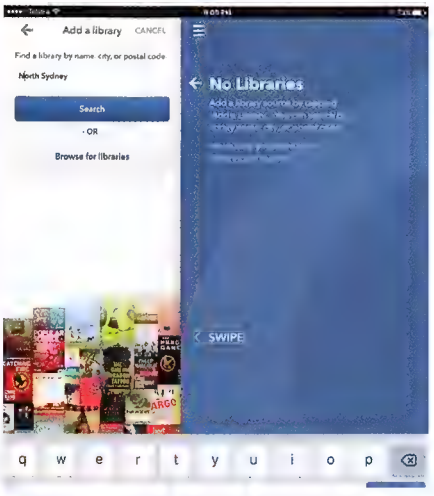
OverDrive works a bit like a web browser, and each book has its own home page that provides more info about the book and the author. You can use these navigation controls to move forwards and backwards through a series of books. It's also possible to read books in a web browser, so you can still read your books on devices that may not have the OverDrive app installed.

How to borrow library books on iOS


OverDrive
Sign up for an OverDrive account to enjoy eBooks, audiobooks, movies, and more from your library.
Sign up
Have an account? Sign in
I am under 13 years old. Continue

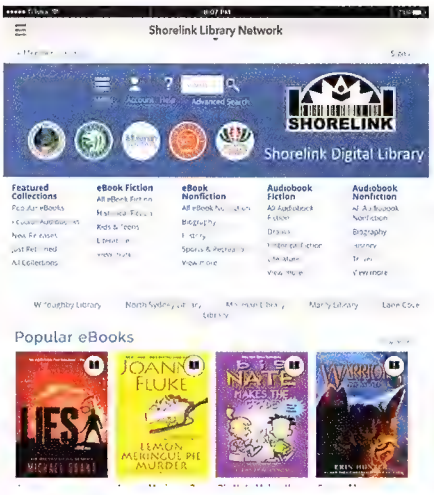
1 OVERDRIVE ACCOUNT

When you first launch OverDrive, you'll be prompted to create an account. You can browse through the app to see how it works first, but you can't actually download any books without one. Creating your account activates the Adobe DRM software — digital rights management — that OverDrive uses to prevent people from making illegal copies of books. Your account also allows you to sync your books, including bookmarks, to multiple devices, such as an iPad at home and an iPhone for the train.



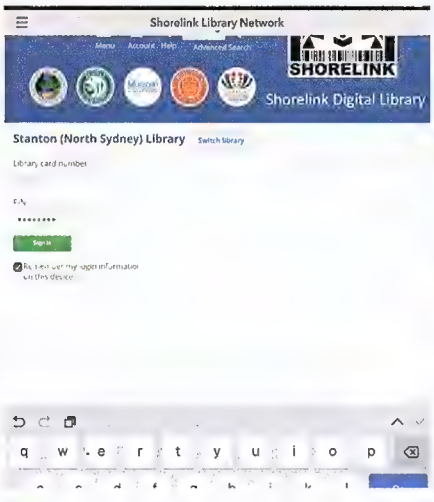
2 LIBRARY LIST

The next step is to tell OverDrive which library you belong to. The developers work with libraries all over the world, and the app includes a list of libraries organised by country that you can browse through. You probably won't find your little local branch library in that list — unless it's well known for having a specialist collection — but enter the name of your city or your local council into the search field and OverDrive will check to see if there's an online library service in your area.



3 FREE BOOKS!

APC's Sydney office comes under the Shorelink Library Network, and there are similar groups of libraries covering most parts of Australia. OverDrive now shows the home page for that group of libraries. The large, grey menu section lists all the different categories of books and audiobooks that are on offer — fiction and non-fiction, and even comics and graphic novels. You can browse the collection from here, but can't actually borrow anything until you are signed in with your library membership details.



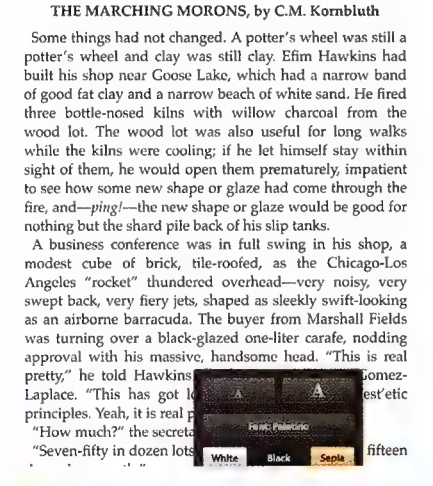
4 LIBRARY CARD

You can only borrow books from a library you belong to, so if you're not already a member of your local library, then this is a good time to sign up. Your library membership card will have both a membership number and a PIN for security, and you need to enter those into OverDrive so it can confirm your membership. OverDrive can connect you to hundreds of libraries all around the world, although most people will just belong to one library in their own local area.

The Second Science Fiction Megapack
25 Modern and Classic Tales by Masters
Series: Megapack
by Robert Silverberg
This title can be borrowed for 21 days.
(Change your lending period)
Borrow
Add to Wish List
Hours of great reading await, with tales from some of the 20th century's most renowned science fiction authors, Here are 25 science fiction stories:
Sample

5 THE BORROW BUTTON

The search tools on your library's home page allow you to browse through categories, or to locate specific authors or titles. All books and audiobooks allow you to read or listen to a short sample before borrowing, and if you click on the author's name, you'll see other books from the same pen. If the book is available, you can click the Borrow button to download it, but if all copies of a book are already on loan, you can add it to your Wish List, and OverDrive will send you an email when it becomes available.


THE MARCHING MORONS, by C.M. Kornbluth
Some things had not changed. A potter's wheel was still a potter's wheel and clay was still clay. Efim Hawkins had built his shop near Goose Lake, which had a narrow band of good fat clay and a narrow beach of white sand. He fired three bottle-nosed kilns with willow charcoal from the wood lot. The wood lot was also useful for long walks while the kilns were cooling; if he let himself stay within sight of them, he would open them prematurely, impatient to see how some new shape or glaze had come through the fire, and—*ping!*—the new shape or glaze would be good for nothing but the shard pile back of his slip tanks.
A business conference was in full swing in his shop, a modest cube of brick, tile-roofed, as the Chicago-Los Angeles "rocket" thundered overhead—very noisy, very swept back, very fiery jets, shaped as sleekly swift-looking as an airborne barracuda. The buyer from Marshall Fields was turning over a black-glazed one-liter carafe, nodding approval with his massive, handsome head. "This is real pretty," he told Hawkins
"How much?" the secreta
"Seven-fifty in dozen lots
White
Black
Sepia
fifteen

6 EASY READING

OverDrive is similar to Apple's iBooks app, showing you each text page individually and allowing you to turn the page simply by swiping left or right. The menu button in the top-right corner allows you to quickly select chapters, while the button in the top-left corner returns you to your library's home page. If you tap in the middle of a page, OverDrive displays additional controls, such as selecting a different typeface and size. And, of course, there are the obligatory social media options.

Build a home-brewed Steam Machine

Bringing PC power to the living room.

There are a few things that set apart the people who game on PCs from the folks who use consoles. For one, PC gamers often choose keyboards and mice, while console gamers just love their controllers (and usually have little choice in the matter). A PC can offer a lot more power and upgradability, while a console is stuck as-is. The biggest thing to note is where people play their games: PC gamers play at desks (mostly), while consoles rule the living room. That's what Steam machines are looking to change.

There are a few Steam machines available for sale already, and surely more to come. But as a PC builder, one must ask: Why buy one when you can build your own? Some of the prebuilt Steam machines out there aren't too different from consoles in that their hardware can't be changed. If you decide to brew your own, the world is your oyster when it comes to hardware and cases.

Steam machines also come in two flavors: SteamOS and Windows. The Windows machines come with Windows and Steam pre-installed, and aren't too different from a normal Windows desktop PC. SteamOS, on the other hand, is Valve's Linux-based OS offering. It basically runs Steam in Big Picture Mode on top of Debian 8. (Ubuntu, Valve's stated 'favourite' Linux distribution, is based on Debian.)

We decided to test out Valve's OS by building a Steam machine that would run SteamOS. That means no Windows 'tax', and no worrying about antivirus software annoying you with popups (or scheduled scans) while you're in-game. We couldn't resist trying it out with our own parts.

SHOVELING COAL

Commercially available Steam machines tend to be a little conservative when it comes to power. The reason is simple: cost. As games will probably be running on a 1080p TV, there's no need to splurge in an attempt to chase the 4K gold at the end of the rainbow, and there's less overhead from the OS and other applications.

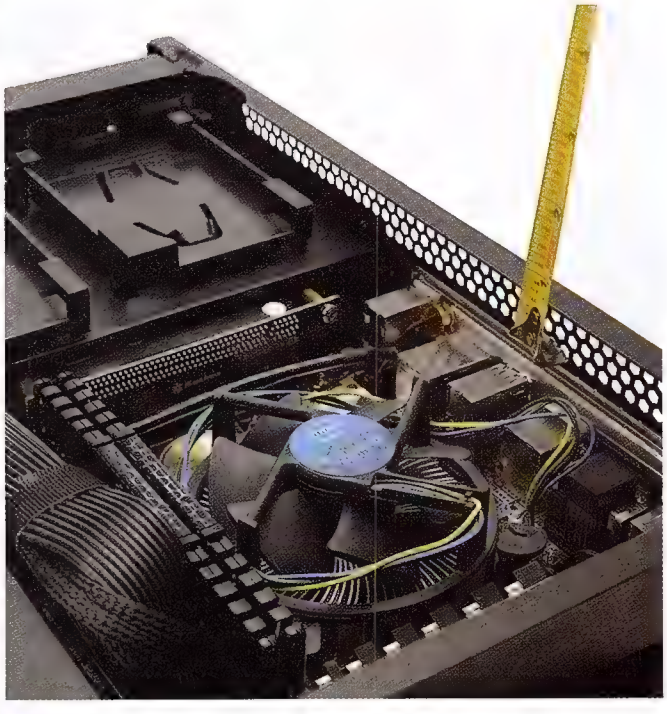
We chose many of the same components that we;ve used in some of our previous budget-oriented builds. We laid the foundation for this machine with the familiar combination of an ASUS Z97I-Plus motherboard and an Intel Core i5-4590, with 8GB of Corsair Vengeance DDR3 RAM. Their new home is a slim SilverStone ML08 mini-ITX case. We also used a SilverStone SFX PSU to power the little rig, and dug up an ASUS GeForce GTX 960 Strix for our video workhorse.

While the Z97 board is a little overkill considering we're going with a locked CPU, it offers plenty of options in the BIOS (as well as PWM connectors). The motherboard also includes a mini-PCIe Wi-Fi card, essential for a rig is designed to run in the living room.

At the time of writing, the Z97I-Plus was hard to find (thus, dearer than its original price). If you can't find it in stock, we recommend an H97I or similar H-class board instead of the Z-class (unless you plan to pick up a K-model CPU). There are a lot of options when it comes to mini-ITX motherboards. And a Skylake-based system won't cost you much more than a Haswell one.

PARTS LIST

PART		STREET PRICE
CPU	INTEL CORE I5-4590 (HASWELL)	$310
GPU	ASUS GEFORCE GTX 960 STRIX 4GB	$330
MOBO	ASUS Z97I-PLUS	$220
MEMORY	8GB (2 X 4GB) CORSAIR VENGEANCE DDR3-1600	$75
CASE	SILVERSTONE ML08B-H	$120
PSU	SILVERSTONE SX500 500W SFX (80 PLUS GOLD)	$140
SSD	250GB SAMSUNG 850 EVO M.2	$145
TOTAL		$1,340

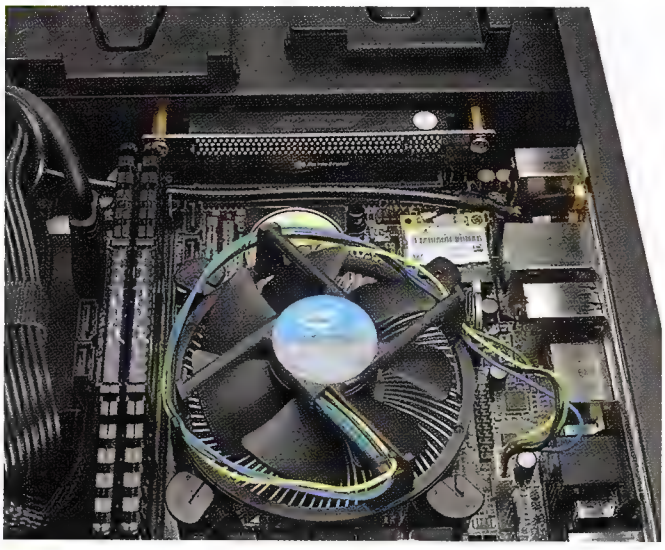


1 DON'T FORGET THE BOILER

If there's one big gotcha about using M.2 with mini-ITX, it's that the mount point is often on the underside of the mobo — we felt really stupid when we had everything in except the SSD. D'oh! While we've established M.2 SATA SSDs as our preferred form factor (as long as prices are on par with 2.5-inch models), the decision to go with M.2 in mini-ITX builds really pays off. Mini-ITX form factors can be hellish when it comes to airflow. With M.2, there's one less cable to route, and if it is your only storage drive, one less power cable. The only problem is that M.2 SSDs are topped out at 500GB at time of writing. Larger-capacity SSDs are still pricey, and 250GB is plenty for the slim SteamOS and a decent game library. If the need arises, you could add 2.5-inch SSDs or hard drives.

2 BOYLE'S LAW

There isn't a lot of room for CPU coolers in the ML08 — there's only about three-quarters of an inch of clearance from the top of the cooler to the side panel. As we went with a fixed-clock i5-4590, we weren't too worried about the use of a stock cooler. However, if you want to go with K-model CPUs, you may want to get a better cooler for overclocking. There are few small-form-factor (SFF) coolers that would be short enough. SilverStone's Argon series is designed to work with the ML08. Corsair recently released an SFF closed-loop cooler, the Hydro Series H5, but even that could prove too thick (at 2.25 inches). If you feel the need for speed in this case, keep a close eye on your temps, as you won't have the thermal headroom you might enjoy in a bigger case. On the bright side, the side panel has a vent above the motherboard, so airflow to the CPU is unobstructed.

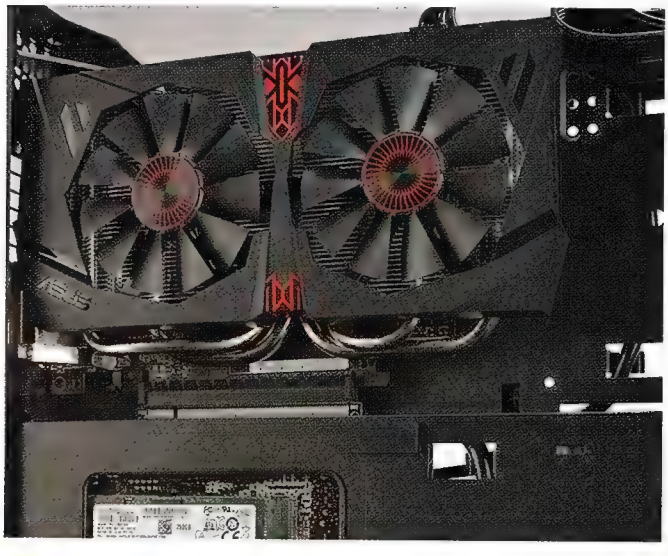


3 THE ELBOW PIECE

Because the ML08 is so slim, the video card can't be mounted in the typical position — perpendicular to the motherboard. However, you can't really move the PCIe slot, so Stone supplied a hard ribbon piece that turns the slot at a right angle for you. The L-shaped hard ribbon secures in place with a pair of screws, so there's no worry about wobble wreaking havoc on your motherboard. The other thing that this piece does is allow for the two-bay design. Locating the GPU in a separate bay from the CPU and motherboard keeps their heat and cooling separate. Warm air from the GPU isn't pumped over your CPU, and vice versa. Cable management is also cleaner, because you don't have to route things around a big video card. USB, audio and power cables are easily routed and plugged in, without concern for obstructing the video card.

4 VIDEO TURBINES

The first thing to notice about the GTX 960 Strix is that it looks so small in its bay. Indeed, we could fit a full-sized GPU — such as a GTX 900 series or R9 300 series — in here if we wanted. You'd just have to keep an eye out for big aftermarket cooling solutions. While there's room for reference model cards, mounting a card sporting three fans wouldn't work. To mount the card, there's an extra riser piece that inserts into the L-shaped PCIe ribbon. It's easy to miss, and if you don't use it, the card won't seat into the two slots properly. On the other end of the card, a cutout allows for PCIe power cables to cross the partition into the video card bay. We recommend using ribbon-style cables or individually sheathed cables, as rounded sheathing would be ungainly. This bay is also the only place to mount a 3.5-inch HDD. If you crave multiple terabytes of storage, you need a video card that's shorter than the 960 Strix.



5 CONCEALED COPPER

The ML08 is a slim case. As a result, we need a slim power supply. We installed SilverStone's 500W SFX model, which gives our rig more than enough juice. The SX500 is fully modular, so we were able to keep cabling to a minimum by going with an M.2 SSD. We used flat ribbon cables, as opposed to rounded sheathed. While rounded sheathed cables help airflow in an ATX case, flat ribbon cables are a boon for the small form factor. We folded our cables over themselves, and positioned them flat against the side of the PSU, keeping them out of the way. There was one more gotcha, though: the power supply's plug isn't exposed to the outside of the case. This means there's no way to externally switch the PSU on or off, so before you close up the case, be sure to switch it on.

6 HOT HANDLES

One thing that's handy on a case is, well, a handle. It makes transportation much easier. The ML087 comes with a handle that is attached to the case with four screws, or left off if preferred. The cool feature is that the handle can be attached to either side of the case, as the side panels are symmetrical. This means there is no true 'top' or 'bottom' to the case, though we feel that the 'right way up' has the video card bay on top. If we could improve on one thing in this case, it would be the handle. It's made of plastic that feels strong enough to support the weight of a small system, but the molding isn't the kindest shape on the hands. Carrying this thing on the train and across town (yes, we tried that) leaves indentations on the fingers, and prompted us to switch hands often. This could be fixed by rubberising the grip.

1 This mounting bracket and area allows for the addition of a slim DVD or Blu-ray drive. Adding such a drive isn't necessary for a Steam machine, though it would be nice if SteamOS would allow the playing of DVDs.

2 The main mounting points for storage is a pair of 2.5-inch brackets for SSDs or laptop hard drives. By going with an M.2 SSD, we could leave these brackets empty, though using a pair of hard drives in RAID 1 wouldn't be a bad idea for backing up games.

3 Of course, Wi-Fi is essential for an Internet-connected device destined for the living room. While wired Ethernet is always best, the 802.11ac card makes sure that the Wi-Fi connection is as good as it can be.

4 A slim opening at the bottom of the video card bay is just big enough for a SATA power and data connector to attach to a 3.5-inch drive. If your video card is too long, say goodbye to the 3.5-inch hard drive.

Low on pressure

Building this little rig was a blast, and went by much faster than other small form factor builds we've worked on. Installing the SteamOS is easy as well, as long as you look out for a couple of things.

First of all, you need to set the Secure Boot option to 'Other OS' in the BIOS. SteamOS and most other Linux distributions aren't able to supply certificates to motherboard vendors. Without a signed certificate, the BIOS will refuse to boot the OS unless you disable Secure Boot.

When we tried the automatic installation for SteamOS, the installer couldn't partition the SSD, for whatever reason. When we tried the 'advanced' installation (it really isn't that advanced, as Linux installations go), everything worked just fine.

There's a dark side to playing games on Linux. The vast majority of games available on Steam are for Windows and use DirectX. Of the games for SteamOS and Linux, only a few are developed with Linux in mind, or use OpenGL as their native API. Thus, many games that are ported have to translate DirectX instructions to OpenGL equivalents somehow. That translation, coupled with slightly lower performance of Linux drivers for GPUs, can amount to big performance hits.

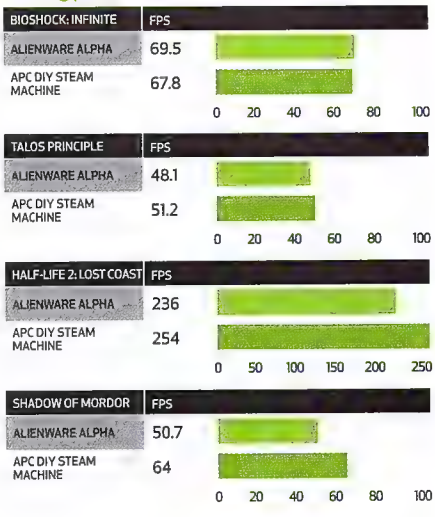
At every turn, the better components in this build spanked the little Alienware Steam Machine. When we compared these results to the Windows-based Alienware Alpha, the margins seemed to thin out. The frame rate in *Bioshock: Infinite* was actually lower than what the Alpha pulled off with its 860M.

SteamOS is still in its infancy. The number of titles available to SteamOS will increase, as will support for Linux if the OS starts to gain steam, so to speak. For now, building a SteamOS box is a fun experiment, but don't expect it to replace your desktop rig just yet.

LABS BENCHMARK RESULTS

The Alienware Alpha is equipped with a Core i7-4675T CPU, GeForce GTX 860M and 8GB of RAM. *Arkham City* tested at 2,560 x 1,440 max settings with PhysX off. *Shadow of Mordor* tested at Max settings.

Gaming performance



12 Raspberry Pi alternatives

The new Raspberry Pi Zero has hit the market, but it's not the only single-board computer available. Darren Yates gives us 12 alternatives.

The world has gone nuts for the new Raspberry Pi Zero single-board computer and although the 'sold out' sign is almost continuously being displayed, there are plenty of Pi alternatives for different applications. Get ready, because after these 12 low-cost options, you may not look at computing the same way ever again. So what are you waiting for? Make something!

ARDUINO 101

Price: approx. US$30
www.arduino.cc

How does an Intel x86-compatible board with CPU for US$30 sound? It's not designed to run Windows, mind you, but the new Arduino 101 features Intel's equally new Curie, a tiny 32MHz/32-bit chip. Arduino is the name the world's maker community turns to most often, providing small low-cost boards for interacting computers with the real world via sensors, LEDs... almost anything you want. Want to make the world's best lightshow next Christmas? You could easily start with Arduino as your base. You code it with the free Arduino app available from the website using its easy-to-learn programming language. It doesn't run Windows or Android, but instead uses what's known as Real-Time Operating System (RTOS) and is aimed squarely at those wanting to build Internet of Things (IoT) devices. With smart features like accelerometer, gyroscope and Bluetooth connectivity built in, it should be perfect for that job. The 'Arduino' branding here is US-centric; elsewhere, the board is the 'Genuino 101'.

BANANA PI M2

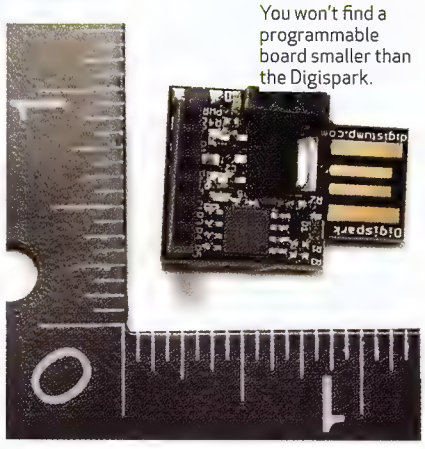
Price: from $78
www.bananapi.com

The Banana Pi is billed as an open-source computer and indeed, you can download the schematic and circuit board designs from the website to make your own. It sits just a touch higher on the performance ladder than the Raspberry Pi 2 with a quad-core Allwinner A31S processor, 1GB of RAM and microSD card slot for storage expansion. There's Gigabit Ethernet, plus HDMI and four USB2.0 ports. It aims to mimic the Raspberry Pi B+ board with a 40-pin GPIO (general purpose input/output) header allowing you to add in your own hardware and make your own gadgets. The Banana Pi website isn't overly stocked with info, but what's great about this one is the range of operating system options available on the site – everything from Raspbian to Android 4.4 to Ubuntu and Fedora Linux. Nice. There's even an input connector for adding a custom camera. Banana Pi also has other board alternatives available.

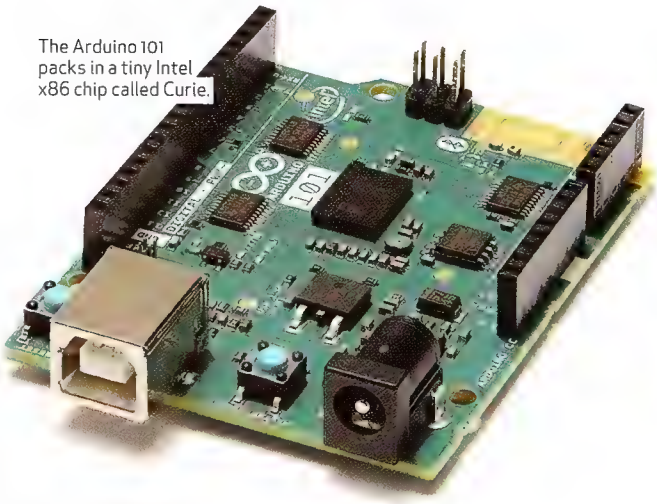
DIGISTUMP DIGISPARK

Price: $3
www.digistump.com

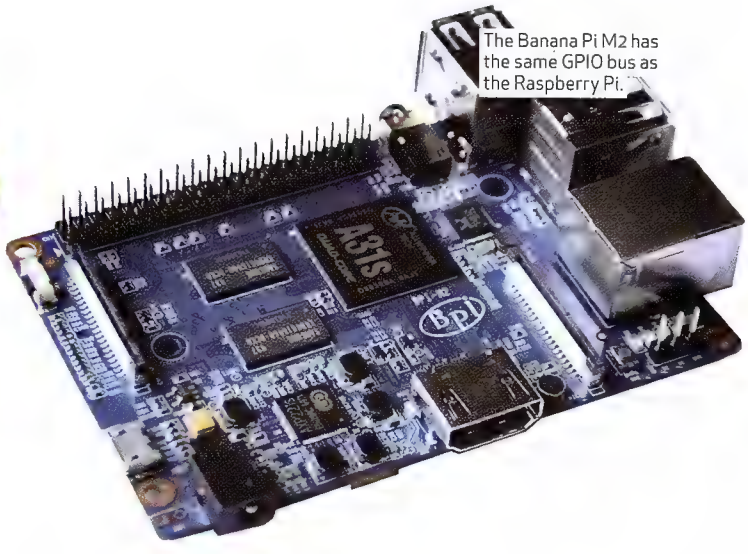
This is the smallest and cheapest board you'll find that's still programming via your PC's USB port. It has an appropriately named Attiny85 microchip on-board and is designed for making simple gadgets. You could easily attach a weather sensor to this one and use it to control a fan or light up a warning light. Available on eBay for under US$2, this is one of many boards you can program with the free Arduino app. It also has useful extras, such as built-in analog-to-digital converter and pulse-width modulation outputs. You might only get 8KB of on-board program storage, but you'll be surprised how little memory you need when you code direct and aren't lumbering around a desktop OS. This thing is tiny – just 25 x 20mm, so it won't take up much space, whatever you put it into. The circuit board is the USB port itself and just slots straight



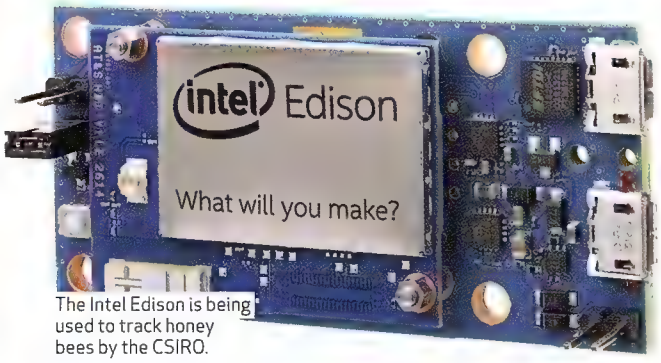
You won't find a programmable board smaller than the Digispark.



The Arduino 101 packs in a tiny Intel x86 chip called Curie.



The Banana Pi M2 has the same GPIO bus as the Raspberry Pi.



The Intel Edison is being used to track honey bees by the CSIRO.

Super-compact MK808B Android miniPC add smarts to any HDMI TV.

into a typical PC USB port. Ideal for teaching kids to build and code.

INTEL EDISON

Price: starting at US$80
www.intel.com

You know something is big when Intel is involved. The chip giant might already support the Arduino 101, but it also has its own maker board called Edison. To give you an idea of how important this class of computer is, the CSIRO uses Edison boards to help discover the cause of colony collapse in honey bees. No honey bees – no food. That's heavy-duty stuff. Some might consider these boards 'toys', but the CSIRO doesn't. Edison features a dual-core Intel Atom CPU clocking at 500MHz, plus a 100MHz Quark microcontroller chip. You get 1GB of RAM and 4GB of flash storage. Throw in dual-band 802.11n Wi-Fi and Bluetooth 4.0, Edison is out-of-the-box ready for IoT action. It runs a mixture of Real-Time OS and Yocto Linux, and like many of these boards, you can program it with the Arduino app. There's no video output, but you do get a USB2.0 port and a range of interfaces, such as serial peripheral interface (SPI) and SD card slot.

MK808B PLUS

Price: starting at US$40

If you took an Android tablet, stripped away the screen and battery, this is all you'd be left with. The MK808B Plus is a tiny Android computer with miniHDMI connector on one end, a Type-A USB host port on the other. Connect it up to a monitor or TV, plug in a USB hub with keyboard and mouse and you have an Android computer system. This budget unit comes variously with Android 4.1, 4.2 (JellyBean) and 4.4 (KitKat), so aim for KitKat. You'll also see dual-core and quad-core chips, so again, check specs before you buy. Despite its diminutive size, the MK808B can play 1080p video, even handle Netflix and games like *Beach Buggy Blitz*. It comes with Gmail and Google Play Store apps and because it uses ARM-class CPUs, it'll run most Google Play apps, including Kodi (formerly XBMC). The 'B' denotes Bluetooth, while the original MK808 only offers Wi-Fi. Small enough to fit into your pocket.

MXIII-G

Price: starting at US$50

You've probably heard a bit about Android-powered TVs recently, but there's a much-cheaper alternative that's often billed as a smart TV set-top box. In reality, these are super-compact computers, often with as much grunt as tablets and phones. The MXIII-G is just one example – we've chosen it for its price (starting under US$50), but also for its ability to playback 4K video. It's powered by a 2GHz Amlogic S812 quad-core ARM-class processor with eight-core graphics. You also get Ethernet, HDMI output, S/PDIF digital audio out, two USB ports and microSD card slot. Some models are sold preloaded with Kodi (formerly XBMC), so you're ready to hook it up to your big-screen telly and enjoy your movie library. It typically comes with Android 4.4/KitKat operating system, but there are more expensive options with Lollipop available.

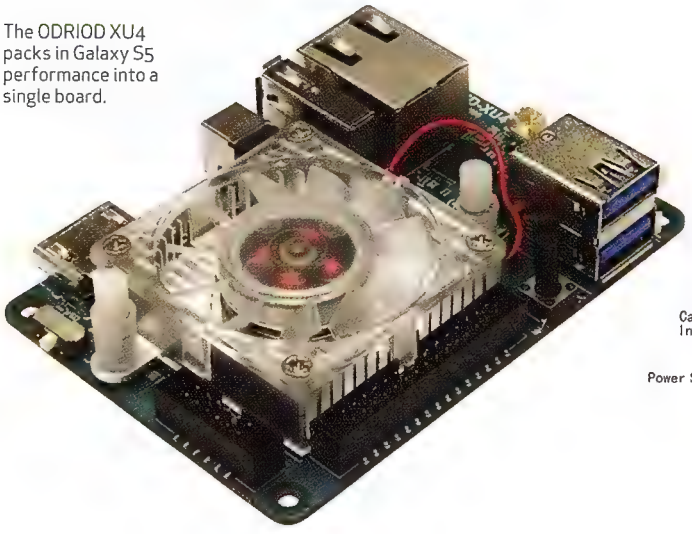
This MXIII-G is an Android PC with enough power to play 4K video.

There's no purpose-built GPIO to play with, but if you like the idea of Android as a desktop OS, plug in a mouse, a keyboard and you're away.

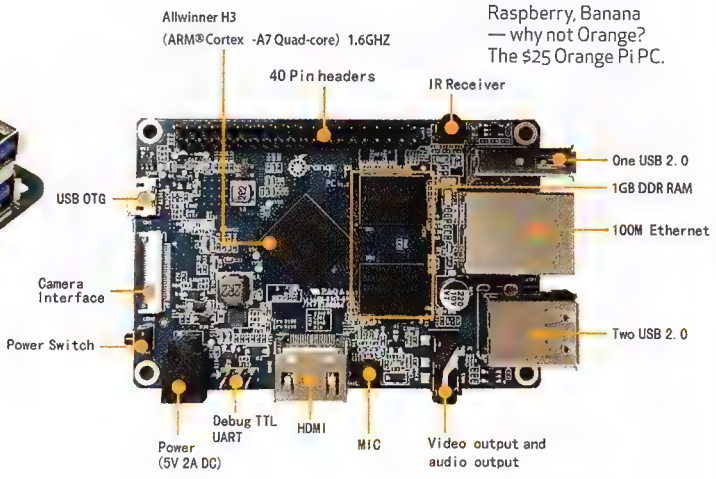
ODROID-XU4

Price: US$75
www.hardkernel.com

Korean maker HardKernel began with its first board featuring Samsung's Exynos 4412 Galaxy S3 chip. Now, this new ODROID-XU4 model has more grunt than most mobile phones. It runs Samsung's eight-core Exynos 5422 Octa chip, packs in 2GB of RAM, two USB3.0 ports, Gigabit Ethernet and HDMI in something about the size of a credit card. You can run Linux or Android (up to Lollipop/5.0 at the moment), but it still has expandable input/output (I/O) ports to plug in your own gadgets. Or you could just turn this into a serious home theatre system. In comparison to the latest Raspberry Pi 2, the XU4 should be roughly three-to-four times faster. Again, it runs ARM-class CPU tech,



The ODRIOD XU4 packs in Galaxy S5 performance into a single board.



Raspberry, Banana — why not Orange? The $25 Orange Pi PC.

so it should have no trouble with most Google Play apps. It might be a little pricey by comparison at US$75, but you're looking at a Galaxy S5 smartphone minus screen and battery, so on that scale, its decent value — and with greater versatility.

ORANGE PI PC

Price: starting from US$25 online
www.orangepi.org

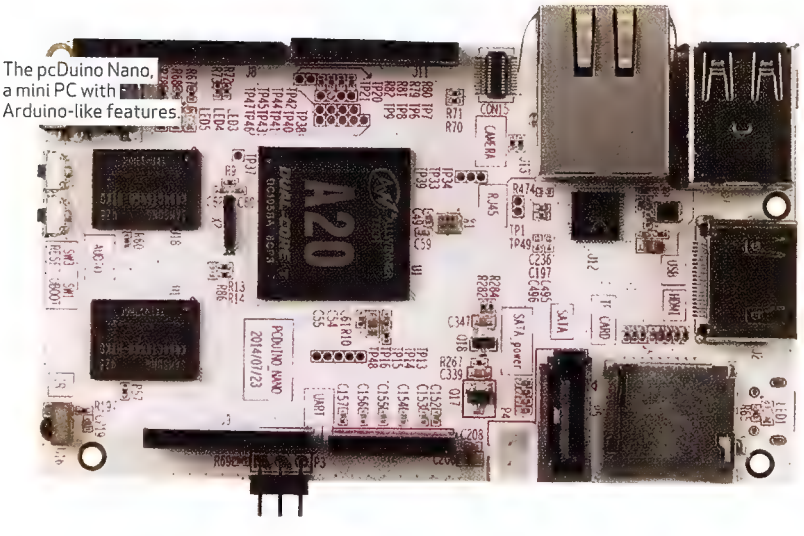
If you're going to have raspberry and banana, well... you can see where this is headed. Orange Pi is another direct Raspberry Pi alternative brand with the Orange Pi PC its cheapest option. Again, it aims to exceed the original Model B R-Pi and with its 1.6GHz Allwinner H3 quad-core Cortex A7 chip, the Orange Pi PC should do that comfortably. There's a gig of RAM on-board, four USB 2.0 ports (one an OTG port), even an actual power switch. Like the Banana Pi, there are a couple of keys here — first, it's another providing a Raspberry Pi Model B-compatible 40-pin GPIO header. But second, because of its Cortex A7 chip, it'll run various OSs from Android 4.4/KitKat and Debian Linux. The makers claim it'll even run Raspberry Pi and Banana Pi OS images.

The thing to be aware of with all of these alternative Pi brands is that community support won't be in the same league as the Raspberry Pi — that's not necessarily a problem, just a fact.

PCDUINO NANO V3.0

Price: starting at $89
www.jaycar.com.au

This is a slimmed-down version of the ODROID-XU4, featuring a dual-core 1GHz Allwinner A20 processor, 1GB of RAM and 4GB of on-board flash, but expandable thanks to a microSD slot and — wait for it — a SATA2 port. Yep, you could potentially run a solid-state drive on this one (there is SATA power on-board, but only a two-pin connector). It's a real liquorice-allsorts with two USB ports, HDMI and Ubuntu Linux operating system support. But what makes this stand out is the Arduino Uno-style pin headers, allowing you to plug in your own hardware components just like an Arduino. The Ethernet port handles up to 100Mbps and there's even a 3.5mm stereo analog output. For an extra $30, you can grab a version with built-in 802.11n Wi-Fi, support for digital audio out, even run it off battery power if you want. By aiming to combine the best of Raspberry Pi and Arduino-like features, you get a single board that has lots of possibilities.

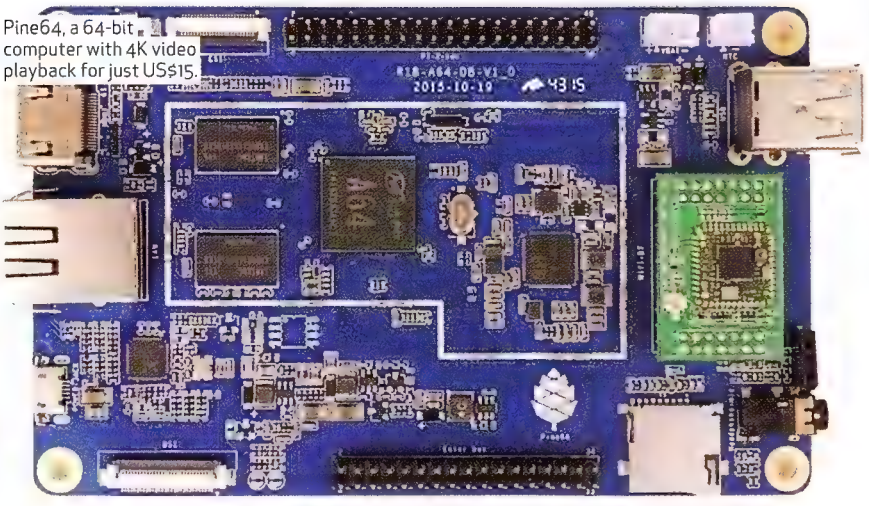


The pcDuino Nano, a mini PC with Arduino-like features.

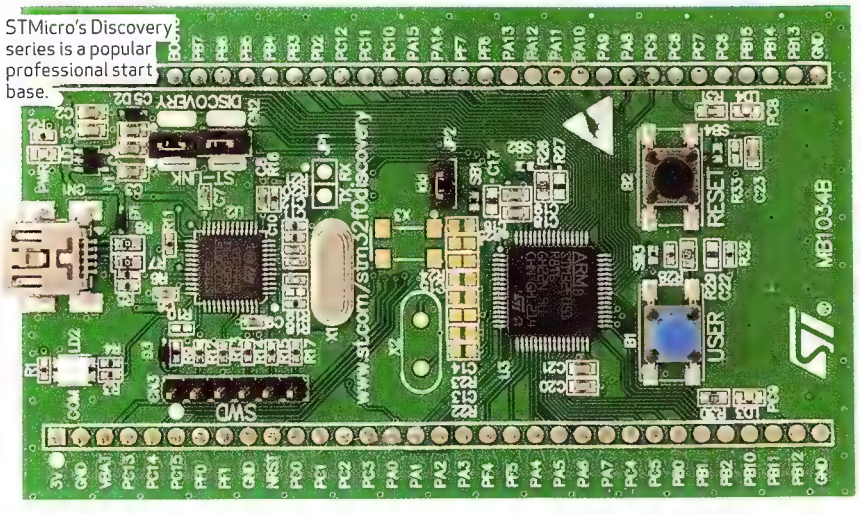
PINE64

Price: US$15
www.pine64.com

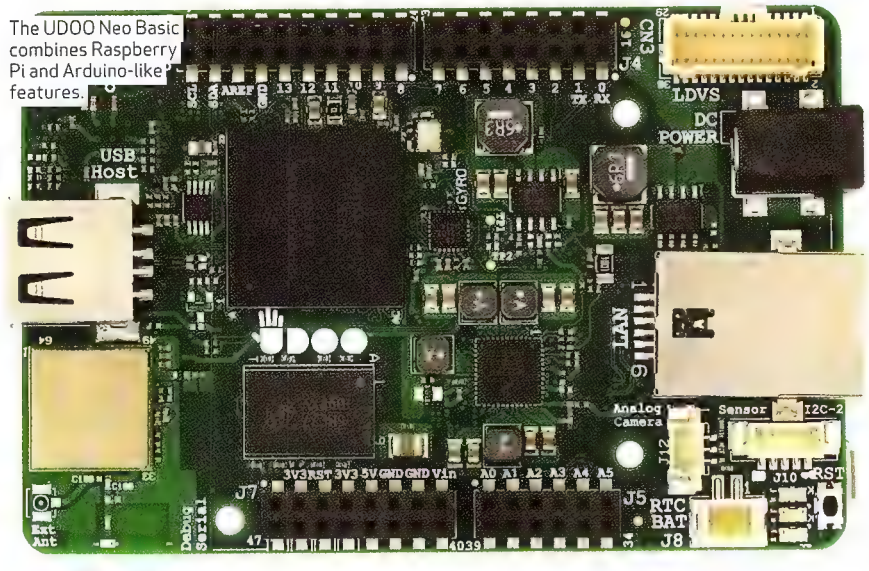
Forget 32-bit computing — a former Apple engineer is behind what's being billed as the first 64-bit computer to be sold for just US$15. Dubbed PINE64, it's the Raspberry Pi Zero on steroids. At time of writing, it had flown passed its original $30,000 Kickstarter goal to the tune of some $1.7 million. It's due for release early 2016 and will run a customised version of Android 5.1/ Lollipop, with apps making it suitable for TV use. It runs a 1.2GHz quad-core Cortex A53 processor from Chinese chipmaker Allwinner and will support up to 4K video playback. About the size of an iPhone 6, you can use it like a Raspberry Pi, add in your own electronic components and make your own gadgets, or just turn it into a home theatre media player, even learn how to code. According to the makers, it'll consume just 2.5 watts of power and can be powered by a single 3.7V Lithium-ion battery.



Pine64, a 64-bit computer with 4K video playback for just US$15.



STMicro's Discovery series is a popular professional start base.



The UDOO Neo Basic combines Raspberry Pi and Arduino-like features.

STM32-DISCOVERY

Price: US$20

STMicroelectronics is one of the big microchip makers in the IoT market. And to help you get involved, it produces basic 'discovery' boards featuring Arduino-style hardware, but with considerably more grunt. Rather than use the Arduino app, the STM32-Discovery boards use ST's own software suite, offering greater access to more serious coding options. If you're ready to create the next killer IoT device, it's a good place to start. There are several different versions but the basic STM32F103 board sells for around $20 and gives you a 72MHz/32-bit chip, very similar to the $5 STM32 boards on eBay, just bigger. Other versions come with built-in LCD screens you can code, even play video on if you're clever. Being more complex to code, they're not quite as popular as Arduino, but if you have a real electronics bent and want to get into the industry, you could do far worse than one of these.

UDOO NEO

Price: starting at US$50
www.udoo.org

UDOO began as a successful Kickstarter campaign that's now a multi-board business. A cross between the original Raspberry Pi and the Arduino Uno, the UDOO Neo Basic delivers an unusual dual-core Freescale i.MX 6SoloX chip with one phone-grade (Cortex A9) and one gadget-grade (Cortex M4) core. You get 512MB of RAM, MicroSD card slot and microHDMI output. But impressively, it supports an analog camera input, Fast Ethernet and Arduino-compatible pin headers. Or you can just use it as a PC with its Android 5.0 and customised Linux OS support. There are two USB ports – one full-size Type-A, the other is a microUSB OTG port. Again, about the size of a credit card, there are several UDOO boards in the lineup, including quad-core models offering more features and speed. UDOO also has sensor modules you can plug in and get creative with. This one will be a touch faster than the Raspberry Pi, but not by much.

Make an Arduino-powered Imperial Doorbell

Arduino can control motors, lights, even record digital audio. But it can also play glorious 8-bit music. Darren Yates explains with a very simple Imperial Doorbell.

A long time ago in a galaxy far, far away, gaming didn't involve the latest multi-channel 24-bit digital audio, but wonderfully archaic 8-bit tones that matched the graphics of the era. The fact the era coincided with *Star Wars: Episode IV* created lots of memories for those of us around at the time. Today, retro game soundtracks are a 'thing', even 8-bit synthesisers are popular.

Unsurprisingly, this is something Arduino can do with aplomb and to pay our own *Star Wars* tribute, we've put together a very simple 'Imperial Doorbell'. Just press the button and it plays the first 12 bars of the Imperial March.

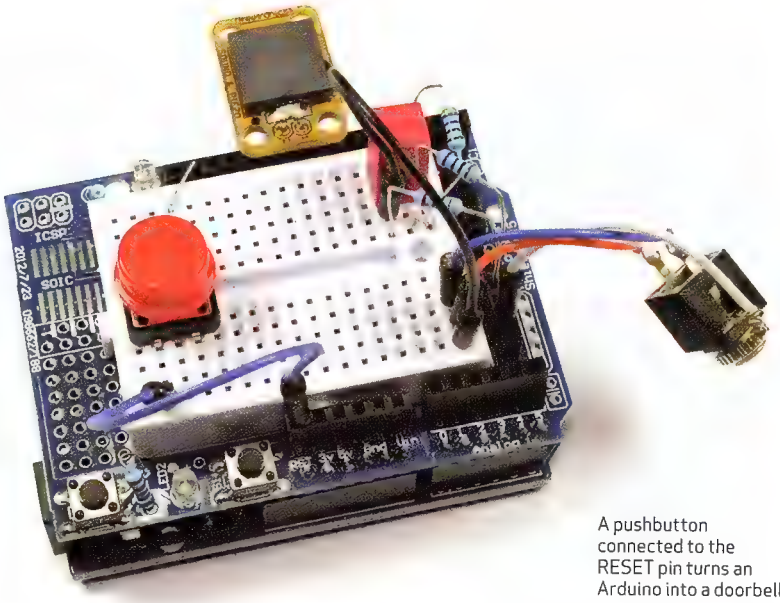
HOW TO MAKE SOUND

Normally, for a computer to make sound, you're looking for a sound card or at least a digital-to-analog converter (DAC) of some description. What makes 8-bit music so distinct is that it doesn't use this new-fangled rubbish – instead, it's created by manufacturing square-wave tones at frequencies that match musical notes.

Square-waves are easy to make because they're just simple oscillations between digital '1' and '0' with a 50% duty cycle (meaning the wave is '1' for half the time, '0' the other half). The distinctive 'edgy' sound comes from the fact that square-waves are full of multiples of the root frequency called 'harmonics'. The faster the oscillations repeat, the higher the tone's pitch and Arduino has a built-in command called 'tone()' that creates sounds at particular frequencies:

Get the code!

Grab the source code from our website at apcmag.com/magstuff. You'll need the Arduino IDE from Arduino.cc. Unzip the source code zip, load the 'ImperialDoorbell.ino' code, built the circuit and flash it to the Arduino.



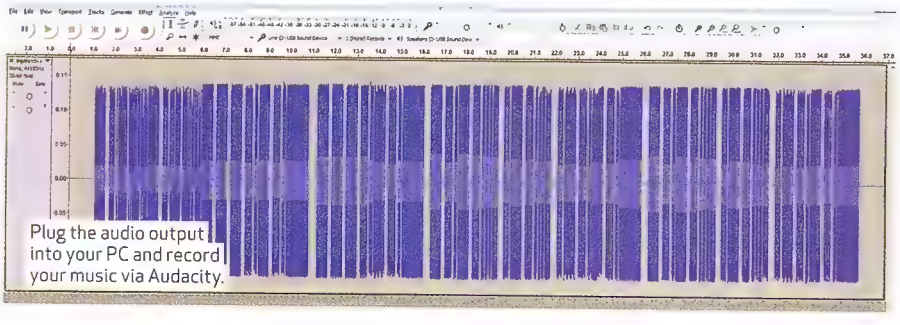
A pushbutton connected to the RESET pin turns an Arduino into a doorbell

```
tone(pin, frequency, duration);
```

...where 'pin' is the Arduino pin you take the sound from, 'frequency' is the pitch in Hertz and 'duration' is the note duration in milliseconds.

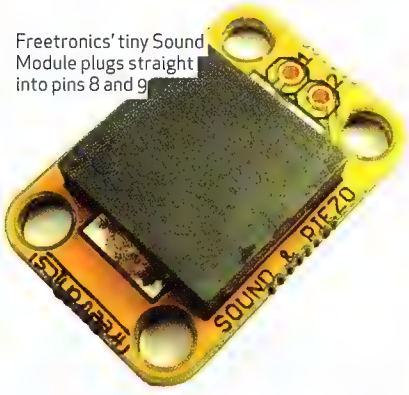
The Arduino IDE includes a sample source code called 'ToneMelody' and we've borrowed it, replacing the original 'Shave and a Haircut' riff melody with the *Star Wars* Imperial March. The sheet music for this is everywhere on the web – we've just converted the melody into digital notes in the source code.

The source code itself has two parts – the ImperialDoorBell.ino 'function

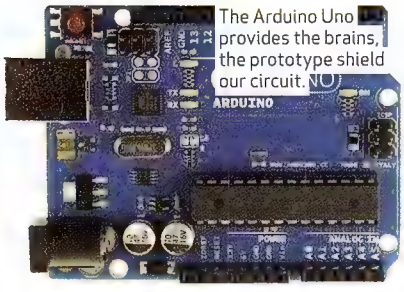


Plug the audio output into your PC and record your music via Audacity.

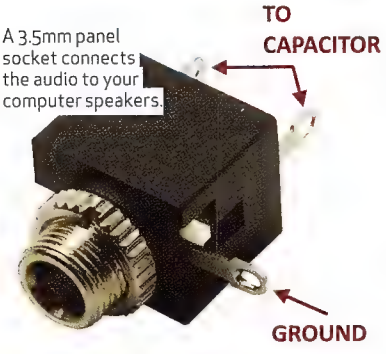
Connect the line output to computer speakers is the easiest way to listen.



Freetronics' tiny Sound Module plugs straight into pins 8 and 9



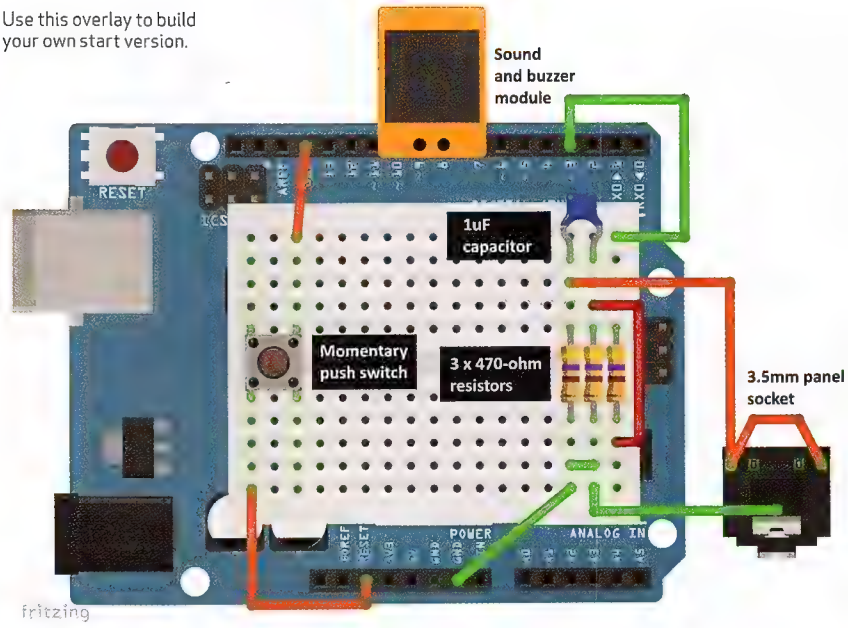
The Arduino Uno provides the brains, the prototype shield our circuit.



A 3.5mm panel socket connects the audio to your computer speakers.

3.5mm panel socket

Use this overlay to build your own start version.



code' that does the work, and 'pitches.h', the 'header' file containing the data for the musical notes.

The Arduino makes music by setting a timer to run for a certain period, toggling the desired pin 'high' and 'low' once during that time. The data in 'pitches.h' are the frequencies of each note in Hertz, which the source code uses to set the time delay.

The end result is a reasonably pitch-accurate set of musical notes and all we do is choose the notes and the required duration, the Arduino does the rest.

HEARING THE OUTPUT

Generating the audio tones is one thing, but how do we hear them? Arduino doesn't have any audio ports, speakers or buzzers built-in. The answer is we build them – and this is where you can get as simple or as complex as you like.

The simplest option is to grab the Sound and Buzzer Module from Freetronics (**freetronics.com/sound**). It's a small piezo speaker board you can plug straight into the Arduino to generate audio tones from zero to 20kHz (although it's best around 1–6kHz). Like a normal speaker, you connect one pin to your audio source output and the other to ground (GND). But to make it easier to use, we've set the Arduino tone output to digital pin 8 and set pin 9 as an artificial 'ground', by switching it to output mode and setting it as digital '0'. An artificial ground doesn't suit every circuit, but can be very useful in the right application. The reason it works here is that the power drawn of the piezo speaker is less than pin 9 can handle when set to digital '0' (called 'sinking' power). For us, it means you can plug the module straight into pins 8 and 9 without any need for connecting wires.

Unfortunately, the module's output level is too low for anything but personal listening, so we also need an alternative. The easy option is to grab a powered computer speaker and plug the Arduino output in via a 3.5mm socket and cable – but first, we must add some protection components.

TOO MUCH OUTPUT

The Arduino pin 3 output has a signal level of five-volts peak-to-peak (5Vp-p or 2.8Vrms) – more than most computer speakers can handle directly without distorting. Another issue is that we need to provide AC-coupling for the audio, so there's no direct-current path from the Arduino to the computer speaker. At the moment, connecting the Arduino straight into an amplifier gives us DC-coupling, so to remedy that, we add three resistors and a capacitor to the Arduino pin 3 output – two resistors form a voltage-divider, dropping the signal level by half, a capacitor provides the AC-coupling and a final resistor connecting the output side of the capacitor to ground ensures there's no 'thump' when the computer speaker is plugged in. Now, you can use the volume control on the speaker to suit.

More techie options include buying a cheap 5VDC audio amplifier module on eBay, or building your own mini amplifier using a tiny LM386 8-pin DIP chip.

One thing, though – the tone() command can only handle one output so swap the lines of code noted in the source code to switch from speaker module to this 'line output' circuitry.

TRIGGERING THE DOORBELL

The last thing is triggering the doorbell itself. The original 'ToneMelody.ino' example shows all function code resides in the setup() method. The basic Arduino rule is the setup() method always runs once, followed by the loop() method running continuously thereafter. By keeping the play code in the setup() method, we just need to add a switch across the Arduino's reset button, connected between the RESET pin and the GND pin, so that when it's pressed, the Arduino reboots and runs the setup() method, playing our Imperial March melody once.

UP TO YOU

If you go the basic Android/powered speaker option, you'll need AC mains to power everything, as batteries won't last more than a week at best. As for the rest of the build (nuts and bolts etc), we'll leave that to you.

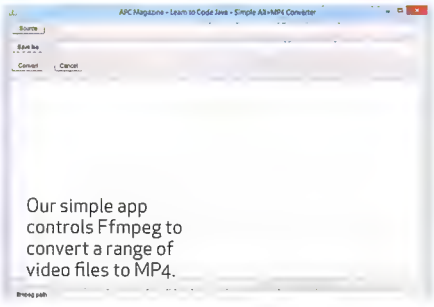
If you want to get into retro 8-bit music generation, Arduino is a great place to start and explore your creative side. ■

Run external apps with Java

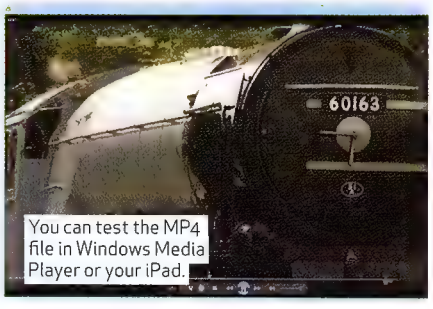
Take control of other apps. Darren Yates explains by showing how to control the FFmpeg command-line video converter to make your own simple transcoding app.

Back in the days of *PC User* magazine (the forerunner to our sister publication, *TechLife*), I wrote lots of apps for the cover disc, including a number of audio/video converters. They tapped into the popular FFmpeg video converter and brought out many of its complex command-line switches into easy-to-use buttons, sliders and comboboxes. Essentially, they were the 'front end' controls for the FFmpeg 'back end'.

Those apps were written using a rapid application development (RAD) system called RealStudio (now Xojo), but many languages support this kind of thing, including Java. Last month, we took our first steps into the world of multi-threaded Java apps with a simple Pi calculator. This time, we'll put that knowledge to more practical use by creating a simple app using FFmpeg that converts almost any video file into MP4 format.



Our simple app controls Ffmpeg to convert a range of video files to MP4.



You can test the MP4 file in Windows Media Player or your iPad.

```
195
196     private void jButton2ActionPerformed(java.awt.event.ActionEvent evt) {
197         JFileChooser fileChooser = new JFileChooser();
198         fileChooser.setDialogTitle("Select save file location");
199         FileNameExtensionFilter filter = new FileNameExtensionFilter("MP4 files", "mp4");
200         fileChooser.setFileFilter(filter);
201         if (fileChooser.showDialog(this, "Select") == JFileChooser.APPROVE_OPTION) {
202             File file = fileChooser.getSelectedFile();
203             if (file.exists()) {
204                 int answer = JOptionPane.showConfirmDialog(null, "File exists. Continue?");
205                 if (answer == JOptionPane.YES_OPTION) {
206                     jTextField2.setText(file.getPath());
207                 }
208             } else {
209                 jTextField2.setText(file.getPath());
210             }
211         }
212     }
213
```

The code here warns if you're about to overwrite an existing MP4 file.

WHAT YOU'LL NEED

Before we get going, you need the latest FFmpeg executable, which you can grab from **ffmpeg.zeranoe.com/builds/win32/static/**. Download the 'ffmpeg-latest-win32-static.7z' file and unzip it somewhere using 7-Zip (**7-zip.org**). You'll also need the Java source code for this masterclass (available at **www.apcmag.com/magstuff**), plus the NetBeans/Java 8 SDK bundle, which you'll find free-of-charge at Oracle (**tinyurl.com/nqnuxfp**). Unzip the source code from the APC website and import the inner 'videcon.zip' file into NetBeans using the 'File, Import Project, From Zip' menu option sequence.

HOW IT WORKS

Looking at things in broad brushstrokes for a moment, our app has two main components – the graphical user interface and the video conversion control mechanism. We've created the interface using NetBean's GUIBuilder and we bring in FFmpeg to do the 'heavy lifting'. But it's not just that – we need some way to launch the FFmpeg executable (.exe) file from within our app, a way to read the ongoing output from FFmpeg, and a way to kill FFmpeg should we need to without killing our app itself.

The best method is to use a separate thread.

RUNTIME & PROCESSBUILDER

Java has two mechanisms for launching external executable files. The original method is Runtime.getRuntime().exec(). It's been around since Java was in nappies and, while it still works, it's no longer the preferred method. Since Java 5 (1.5), that role has been taken over by the ProcessBuilder() class.

Each time you launch an app, you're launching an instance of that app, called a 'process'. Java allows you to create processes you can control, read output from and even kill off if you want and it's this capability we'll use here.

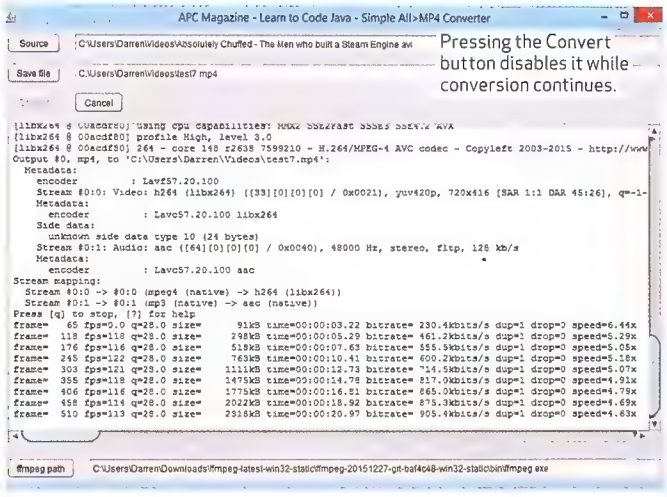
DIFFERENCES

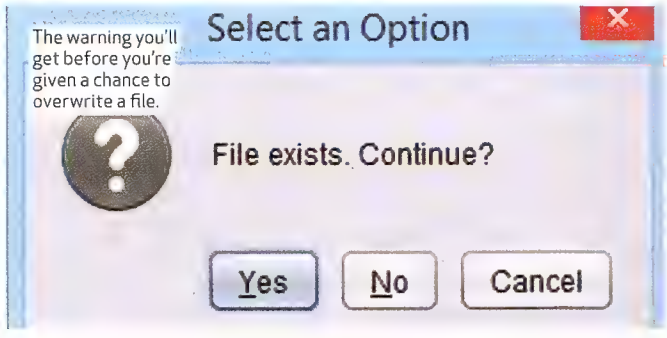
What's the difference between getRuntime.exec() and ProcessBuilder()? For our purposes, its in how they handle the actual FFmpeg commands we feed in. FFmpeg has a million and one options, but if you're happy to use the default settings, you can, for example, convert an AVI (audio-video interleaved) file into MP4 using just:

```
ffmpeg -i "c:\downloads\input.avi" -y "c:\video files\output.mp4"
```

The command-line tool automatically detects the video and audio codecs used by the AVI input file and knows the codecs required when you specify an output file with a 'MP4' suffix (H.264 video and AAC audio codecs). The '-y' code or 'switch' just tells FFmpeg to overwrite the output file, even if it already exists (but this means your app must warn users attempting to select an existing file).

See the space between the words 'video' and 'files' in that output file path? These spaces need to be accounted for not just by FFmpeg (which is why each path is encased in double-quotes), but also by Java. Otherwise, it won't work. The normal method for handling this is to use 'escape sequencing', where you add a backslash (\) to ensure Java knows to parse the following special character as a text character and not part of an programming statement. For example, double-quotes (") are normally used to


APC Magazine - Learn to Code Java - Simple AV>MP4 Converter
Source
Save file
Cancel
Pressing the Convert button disables it while conversion continues.
ffmpeg path



"Java allows you to create processes you can control, read output from and even kill off if you want."

surround text for string assignment, but you may want to have them appear in a string also. Here's an example:

```
  String text1 = "This is a
string with no quotes";
  String text2 = "This string
has the quote \"coding is
fun\"";
```

Print these strings and for 'text1', you'll get:

```
  This is a string with no
quotes
```

```
  But here's what you'd see
with 'text2':
```

```
  This string has the quote
"coding is fun"
```

The escape sequence tells Java how to handle the next character – you can see the two double-quotes at the end of the 'text2' string, the first is displayed; the second signals the end of the string.

Getting back to FFmpeg command-driving, Windows allows spaces in filepaths, but FFmpeg uses a space to separate command parameters, so using the double-quotes ensures FFmpeg knows all of the text within the double-quotes is the filepath and not part of a command-line parameter separator.

In terms of getRuntime.exec() and ProcessBuilder(), getRuntime.exec() has the same trouble with spaces as Ffmpeg. However, in order to send the double-quotes to FFmpeg, we have to use the escape sequence, making things doubly awkward. ProcessBuilder(), on the other hand, internally handles spaces, letting you send each parameter as part of a parameter list.

BOTH OPTIONS

We've implemented both options in the source code – the convertVideo() method uses the getRuntime.exec() method, while convertVideoPB() uses the newer ProcessBuilder() alternative. The source is set to use the ProcessBuilder() version initially, but just go to the VideoThread() class and change the last line in the run() method from 'convertVideoPB' to 'convertVideo' to use the getRuntime.exec() option.

There's no practical difference in the video conversion speed using either one – you'll just get a bit of practice in how they work.

WHAT'S HAPPENING?

In its current form, the user interface has just two FFmpeg function buttons, Convert and Cancel, which start and stop the video conversion process, respectively. The other three buttons in the GUI are for selecting the source file, the save file location and the location of the FFmpeg executable. We won't cover file selection here as they're all basically the same – we use the JFileChooser() class to create a customised file dialog box, which allows us to grab the filepath of the file for each section and then display them in the corresponding JTextFields. We've looked at JFileChooser() in previous masterclass episodes.

The app expects you to set all three filepaths before you can convert a file. But once that's done, you're ready to hit the Convert (jButton3) button and as soon as you do, the jButton3ActionPerformed() method is triggered and runs its code. That starts with a warning if you've forgotten the Ffmpeg path; otherwise, it ends with:

```
  jButton3.setEnabled(false);
  Thread videoThread = new
Thread(new VideoThread());
  videoThread.start();
```

Here, we're launching FFmpeg as the second thread – the second line creates a new Thread object called 'videoThread' and the third line starts it.

Take a quick look at the VideoThread() class and you'll see it implements the Runnable interface. We talked about this last month, but just quickly, implementing Runnable is the key to enabling a class to run as a separate thread and the code we run has to be located in the class's run() method. The little trick we also mentioned is that we call 'VideoThread.start()', not 'VideoThread.run()' because calling the latter simply runs the code in that run() method – you need the start() method, which first creates the new thread and runs the code inside run().

CANCELLING A PROCESS

Launching an external app as a separate process and thread is all well and good, but we need some way of being able to stop it. Imagine watching your car run downhill, off into the sunset...

Java has your back here, with a simple solution that's easy to implement. Notice in the source code we're creating an instance of the Process class called 'processFfmpeg' and using it as the handle for either the getRuntime.exec() or ProcessBuilder options, based on which one you activate. The Process class lets you kill that process by just calling the Process.destroy() method. Look at the source code for the Cancel button (jButton5) and it has just two lines:

```
  processFfmpeg.destroy();
  jTextArea2.append(">>>
CONVERSION CANCELLED BY USER.
\r\n");
```

The first line kills the FFmpeg app process, the second provides notification to the screen. That's about as simple as it gets.

WHY THREADS ARE IMPORTANT

FFmpeg provides lots of useful output during transcoding – each line gives you a rolling update on the current frame being encoded, overall bit rate, file size, file time position and average frames per second (fps) conversion speed.

Because we're using Java's Process class, we can programmatically grab that information relatively easily and display it in real-time. It comes back from FFmpeg via the process class through two streams – the 'error' stream and the 'input' stream. The error stream contains any information output by FFmpeg if it crashes or ends, while the input stream returns the rolling FFmpeg output data (output from FFmpeg becomes input for Java, hence the use of 'getInputStream').

Look in the source code for the methods 'convertVideo' and 'convertVideoPB' and you'll see we're implementing a BufferedReader for each, 'bres' for the error stream and 'bris' for the input stream. A while() loop combined with the BufferedReader's readLine() method reads the data from each buffer and appends it to jTextArea2 on our GUI display.

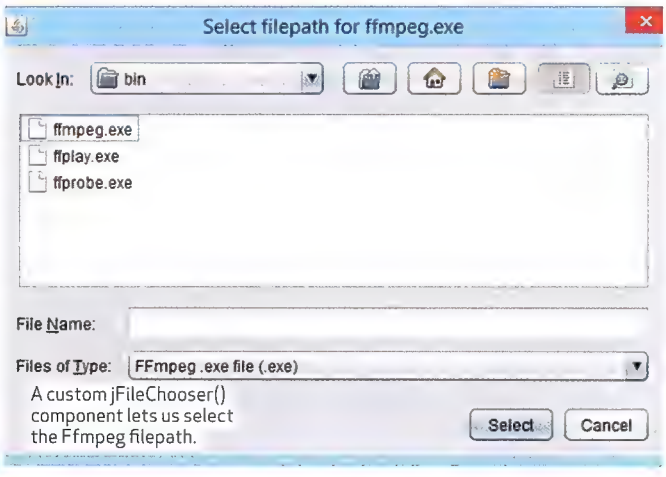
This is one reason why having FFmpeg on a separate thread is crucial. If Ffmpeg runs on the main/GUI thread, you'd see nothing on the jTextArea2 GUI component until FFmpeg completed its run because the GUI/main thread would have to wait for FFmpeg to finish before it could update the GUI itself, which is useless.

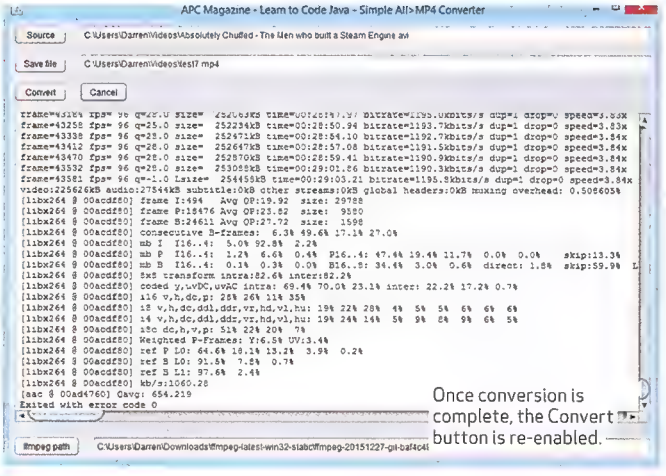
ERROR HANDLING

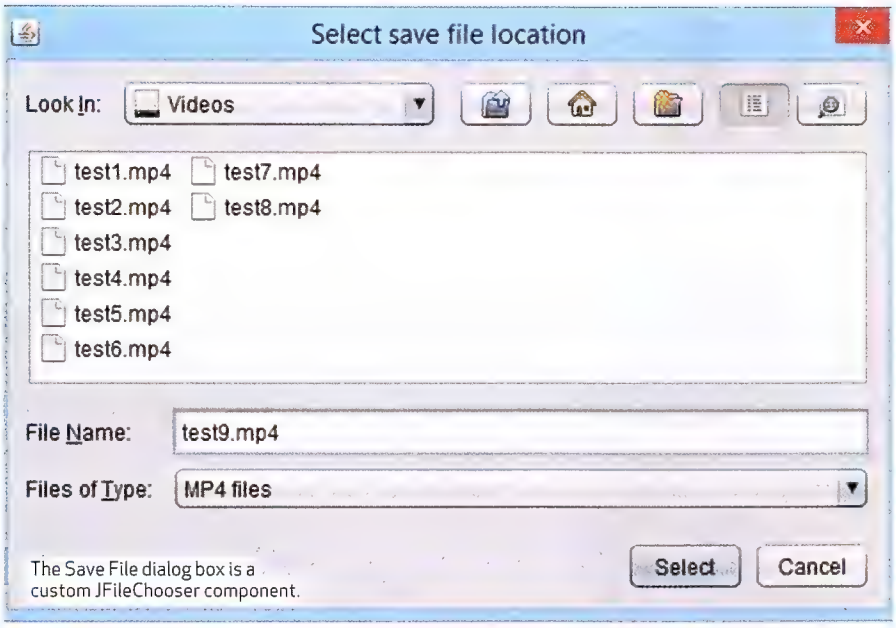
One area we haven't looked at much is error-handling. You'll find books on this topic alone, so we can't do it justice here. But for the moment, it's enough to say significant app development time normally goes into ensuring users can't break your app.

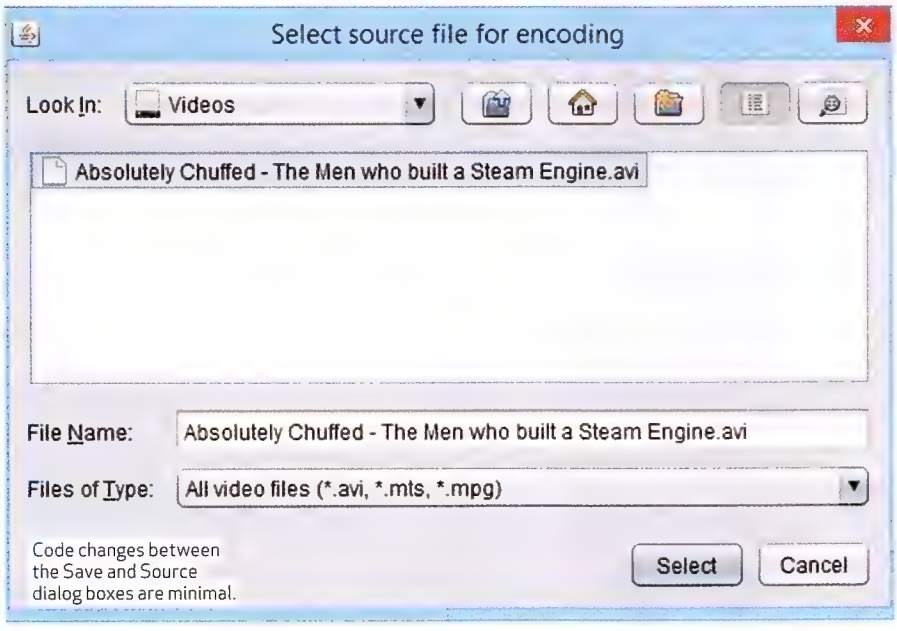
For example, let's say the user has everything selected and presses the Convert button to launch the conversion process. What happens if they press it again? If they press the button while conversion is continuing, Java will action the button press, start another thread and launch a new version of FFmpeg to begin transcoding the same file. In fact, it'll create a new version of FFmpeg inside a new thread for each Convert-button press.

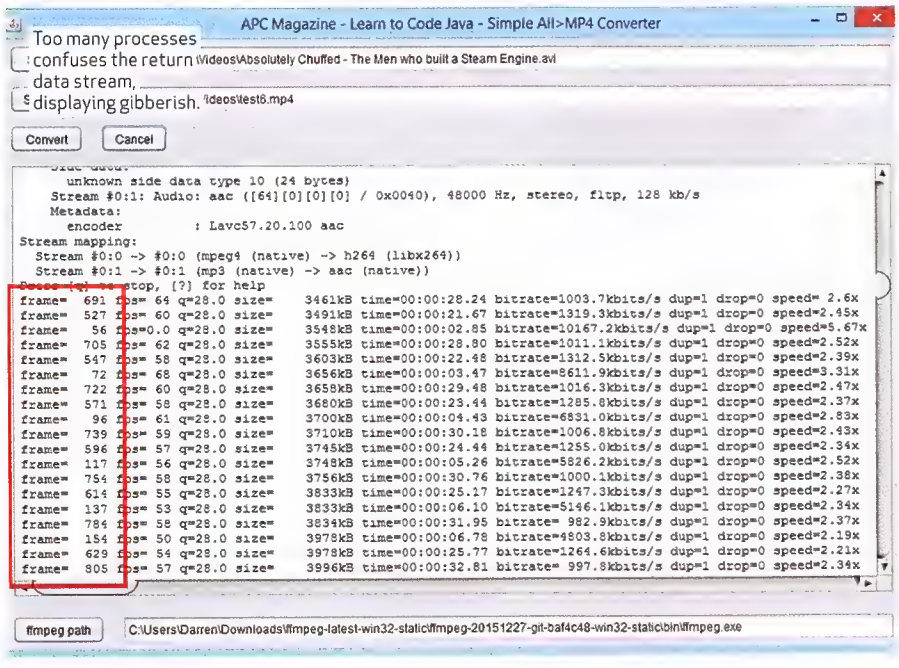
That's bad for lots of reasons, but here's just two. Having multiple




APC Magazine - Learn to Code Java - Simple All>MP4 Converter
Source
Save file
Convert
Cancel
Once conversion is complete, the Convert button is re-enabled.




Select source file for encoding
Look In:
Videos
Absolutely Chuffed - The Men who built a Steam Engine.avi
File Name:
Absolutely Chuffed - The Men who built a Steam Engine.avi
Files of Type:
All video files (*.avi, *.mts, *.mpg)
Code changes between the Save and Source dialog boxes are minimal.
Select
Cancel


APC Magazine - Learn to Code Java - Simple All>MP4 Converter
Too many processes confuses the return data stream, displaying gibberish.
Videos\Absolutely Chuffed - The Men who built a Steam Engine.avi
Videos\test6.mp4
Convert
Cancel
unknown side data type 10 (24 bytes)
Stream #0:1: Audio: aac ([64][0][0][0] / 0x0040), 48000 Hz, stereo, fltp, 128 kb/s
Metadata:
encoder : Lavc57.20.100 aac
Stream mapping:
Stream #0:0 -> #0:0 (mpeg4 (native) -> h264 (libx264))
Stream #0:1 -> #0:1 (mp3 (native) -> aac (native))
Press [q] to stop, [?] for help
frame= 691 fps= 64 q=28.0 size= 3461kB time=00:00:28.24 bitrate=1003.7kbits/s dup=1 drop=0 speed= 2.6x
frame= 527 fps= 60 q=28.0 size= 3491kB time=00:00:21.67 bitrate=1319.3kbits/s dup=1 drop=0 speed=2.45x
frame= 56 fps=0.0 q=28.0 size= 3548kB time=00:00:02.85 bitrate=10167.2kbits/s dup=1 drop=0 speed=5.67x
frame= 705 fps= 62 q=28.0 size= 3555kB time=00:00:28.80 bitrate=1011.1kbits/s dup=1 drop=0 speed=2.52x
frame= 547 fps= 58 q=28.0 size= 3603kB time=00:00:22.48 bitrate=1312.5kbits/s dup=1 drop=0 speed=2.39x
frame= 72 fps= 68 q=28.0 size= 3656kB time=00:00:03.47 bitrate=8611.9kbits/s dup=1 drop=0 speed=3.31x
frame= 722 fps= 60 q=28.0 size= 3658kB time=00:00:29.48 bitrate=1016.3kbits/s dup=1 drop=0 speed=2.47x
frame= 571 fps= 58 q=28.0 size= 3680kB time=00:00:23.44 bitrate=1285.8kbits/s dup=1 drop=0 speed=2.37x
frame= 96 fps= 61 q=28.0 size= 3700kB time=00:00:04.43 bitrate=6831.0kbits/s dup=1 drop=0 speed=2.83x
frame= 739 fps= 59 q=28.0 size= 3710kB time=00:00:30.18 bitrate=1006.8kbits/s dup=1 drop=0 speed=2.43x
frame= 596 fps= 57 q=28.0 size= 3745kB time=00:00:24.44 bitrate=1255.0kbits/s dup=1 drop=0 speed=2.34x
frame= 117 fps= 56 q=28.0 size= 3748kB time=00:00:05.26 bitrate=5826.2kbits/s dup=1 drop=0 speed=2.52x
frame= 754 fps= 58 q=28.0 size= 3756kB time=00:00:30.76 bitrate=1000.1kbits/s dup=1 drop=0 speed=2.38x
frame= 614 fps= 55 q=28.0 size= 3833kB time=00:00:25.17 bitrate=1247.3kbits/s dup=1 drop=0 speed=2.27x
frame= 137 fps= 53 q=28.0 size= 3833kB time=00:00:06.10 bitrate=5146.1kbits/s dup=1 drop=0 speed=2.34x
frame= 784 fps= 58 q=28.0 size= 3834kB time=00:00:31.95 bitrate= 982.9kbits/s dup=1 drop=0 speed=2.37x
frame= 154 fps= 50 q=28.0 size= 3978kB time=00:00:06.78 bitrate=4803.8kbits/s dup=1 drop=0 speed=2.19x
frame= 629 fps= 54 q=28.0 size= 3978kB time=00:00:25.77 bitrate=1264.6kbits/s dup=1 drop=0 speed=2.21x
frame= 805 fps= 57 q=28.0 size= 3996kB time=00:00:32.81 bitrate= 997.8kbits/s dup=1 drop=0 speed=2.34x
ffmpeg path
C:\Users\Darren\Downloads\ffmpeg-latest-win32-static\ffmpeg-20151227-git-baf4c48-win32-static\bin\ffmpeg.exe

versions of FFmpeg encoding the same file to the same destination from the start just slows the real conversion process by a factor of the number of Ffmpeg copies running, since each process demands CPU time. And at the end, when each one tries to close the output file, it'll turn pear-shaped real quick.

However, far worse is this – each time you press the Convert button, you're telling Java to create a new Process instance and assign it to the variable 'processFfmpeg'. But what happens to the previous thread assigned to 'processFfmpeg'? Assigning a new process to 'processFfmpeg' doesn't kill off the previous one – it just abandons it. The only process your app can now kill is the latest one assigned to 'processFfmpeg'. You've lost control of any previous processes and the only way to stop them is to go into Windows' Task Manager (if you're using Windows), look for the ffmpeg.exe background processes and kill them off manually. That's hardly text-book user experience!

The simplest solution is to just disable the Convert button as soon as it has been pressed and only re-enable it when either the Cancel button as be pressed or the transcode process is completed or stops. That way, you shouldn't have multiple process threads dangling, chewing up resources, with no control – and that's what the 'jButton3.setEnabled(false)' statement does right at the start of the jButton3ActionPerformed() method.

USING THE APP

Finally, using the app is pretty straightforward – press the FFmpeg path button and locate the ffmpeg.exe file from your downloaded zip (hint: it's in the 'bin' subfolder). Next, press the Source button and choose your source video file. After that, press the Save file button and choose a savefile location. When you're done, press Convert to start, Cancel to stop. FFmpeg will automatically use whatever number of cores your CPU offers to maximise conversion speed.

Overall, the key feature that makes this app work is splitting off that FFmpeg process into a separate Java thread. If you try to keep it on the 'main' GUI thread, the GUI will just lock up until FFmpeg completes the conversion – that not only means no on-the-go output updates, but importantly, you have no way to kill the FFmpeg process if necessary, either. If you're trying to convert a 4K rip of a three-hour movie using a single-core Celeron computer, you could lose control of the GUI for days! ■

Install Android 6.0 on your PC

Forget phone updates: chuck Marshmallow onto your PC! Darren Yates shows you how to get it installed and running.

We've been looking at Google's new Android 6.0/ Marshmallow over recent months, what's new and, thanks to the developer community, how you can get it working even on older devices like Samsung's Galaxy S3 smartphone.

Meanwhile, the team from Android-x86 has been doing impressive work porting our favourite OS to Intel architecture over the last couple of years, going all the way back to Ice Cream Sandwich/Android 4.0.

We showed you recently how to run Android 5.1.1/Lollipop as a virtual machine on your PC, but just before Christmas, the Android-x86 team pushed out their first Android 6.0/ Marshmallow 'release candidate' for Intel-based PCs. We've taken 'RC1' for a spin, and this month, we'll look at how to install it on actual hardware.

From our experience, it still needs a few tweaks, but if you have an old PC holding up one end of your coffee table, here's one option that might just give it a new lease of life.

WHAT YOU'LL NEED

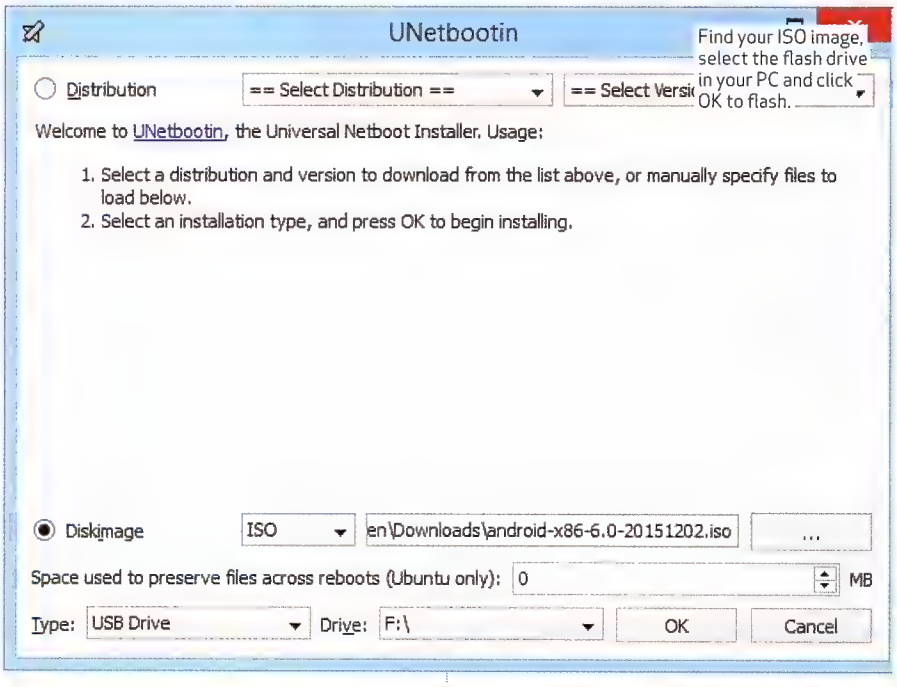
You'll need a few things to get this working, starting with UNetbootin (**unetbootin.github.io**), a 4GB USB flash drive (even a 2GB drive will do) and, of course, the 430MB Android-x86 6.0/Marshmallow distro ISO image, which you'll find at **tinyurl.com/apc426-marsh**. Just aim for the latest 'android-x86-6.0' ISO file.

You'll also need that old PC or notebook. We recommend if it still has a working hard drive with installed OS and software that you remove it and replace it with a spare drive you don't mind reformatting, preferably a small-size solid-state drive. That way, if Marshmallow doesn't float your boat, you can put back the original drive and your old system is as it was. The replacement drive doesn't need to be much – phones run Android with as little as 8GB of flash, so anything 8GB to 64GB would be perfect.

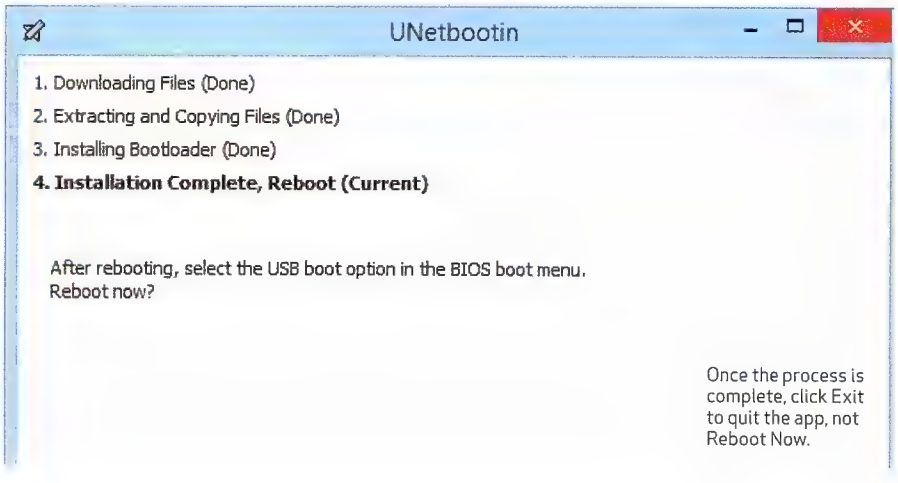
HARDWARE COMPATIBILITY

The last time we looked at installing Android on PC hardware a couple of years ago, we had a few reader questions concerning driver support, with reports some integrated peripheral devices weren't working. Unfortunately, there's not much you

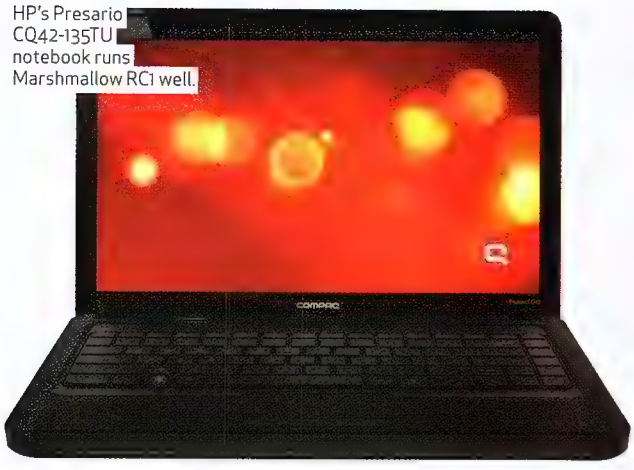
Marshmallow supports USB gamepads on games like *Beach Buggy Racing*.



Find your ISO image, select the flash drive in your PC and click OK to flash.


UNetbootin
1. Downloading Files (Done)
2. Extracting and Copying Files (Done)
3. Installing Bootloader (Done)
4. Installation Complete, Reboot (Current)
After rebooting, select the USB boot option in the BIOS boot menu.
Reboot now?

Once the process is complete, click Exit to quit the app, not Reboot Now.



HP's Presario CQ42-135TU notebook runs Marshmallow RC1 well.

We had no trouble getting Logitech's F310 USB gamepad working.

can do about that, since, unless apps include their own device drivers, you're limited to the drivers built into the Android-x86 image.

That said, we tested this Marshmallow RC1 on an old Compaq Presario CQ42-135TU notebook from 2010 and, from a hardware perspective, it worked really well. We had the internal Wi-Fi up and running from the start, full-screen pixel resolution, built-in audio, USB – even the notebook's function keys controlling screen brightness and audio levels worked beautifully, right down to the Print Screen button grabbing screenshots we've used here.

The CQ42-135TU doesn't have built-in Bluetooth, but we had no trouble plugging in an el-cheapo generic Bluetooth USB dongle we picked up online for $2 – Marshmallow found it and automatically linked to it through the Settings/Bluetooth menu option.

But as with everything, your mileage will vary – that's why we recommend using a spare drive, rather than overwriting a working system drive. Marshmallow might not work for you.

In our test system, we swapped out the original 250GB Seagate system drive for an old serviceable 64GB OCZ Vertex 2 SSD we had lying around.

FLASH ISO TO USB FLASH

The Android-x86 Marshmallow ISO is similar to most Linux distros in that it has two operating modes – you can boot it up into 'live' mode straight off the bat, where nothing is installed to the PC's hard drive, the OS just loads into memory and it's good to go. However, we think the better option is 'installation' mode, which installs the OS to your device's internal storage – it gives your setup persistence (meaning changes stay when you reboot).

To get the OS onto your USB flash drive first, plug the drive into your Windows PC and backup any important files. Next, launch UNetbootin and, when it pops up, press the press the browse ('...') button on the far-right of the 'Diskimage' radiobutton and locate the Android-x86 ISO image you downloaded earlier. Make sure the 'drive' entry at the bottom of the app window is pointing to your USB flash drive and, when you're ready, press the 'OK' button.

It'll take about a minute or so while your flash drive is made bootable and the ISO image is unpacked onto the flash drive. When completed, exit UNetbootin (don't select 'reboot'), remove the flash drive and plug it into your old notebook or desktop box.

UNetbootin doesn't specifically support Android-x86 in its 'distribution' listing at the top of the app window, but this method we've just outlined works perfectly well.

INSTALLING MARSHMALLOW

Now boot up your old PC into the 'select boot device' menu, choose the flash drive and boot up. You should end up with the UNetbootin boot-screen menu. Quickly scroll down to the 'Installation' option and press the Enter key.

The next screen will ask you to select a partition to install the OS to – check for 'sda1', which should be the primary boot drive (not the flash drive) and check the filesystem format next to it. If it doesn't say 'ext4', scroll down and choose 'Create modify/partitions'.

On the next screen, you'll see the drives listed – select 'sda', which should also be labelled 'harddisk'. Next, select 'No' when asked if you want to use GPT (GUID Partition Table) for the drive. After that, if you get a big black warning screen about 'unsupported GPT found', just press Enter. This should take you into the cfdisk disk partitioning tool..

Remember, you're about to erase everything on this drive, so be sure to back up any files you need before you install the drive into your PC – there's no retrieving lost data beyond this point.

The key to having Marshmallow work is ensuring your system drive is formatted to EXT4; if you don't, Marshmallow will still install to the drive, but you won't be able to download and install any apps. (We know because we tried EXT3 and that's what happened!)

Using cfdisk, you need to delete any existing partition, create a new 'primary' partition, make it 'bootable' and finally, write the partition table

Marshmallow on a 2010-era Celeron notebook is fine for *Clash of Clans*.

information to the disk using the menu at the bottom of the screen. If you don't do the 'write' bit, the changes won't commit. After that, select 'Quit' from the menu, you'll go back to Marshmallow's install process and you now choose the new partition as the installation drive.

When asked, you want to install the 'GRUB' boot loader, not 'EFI GRUB2' as this will fail on older systems. And select 'No' when asked to make the '/system' folder read-write.

Once the image has been copied to the system drive, select 'reboot' on the new window, remove the flash drive and your PC should reboot into the GRUB boot menu. Choose the top menu entry (or just wait a few seconds) and Android will begin booting up.

The good news is that because Android-x86 6.0 is based on Google's AOSP (Android Open-Source Project), the first-boot process should be pretty familiar. Just follow the prompts through to the end.

WHAT WORKS, WHAT DOESN'T?

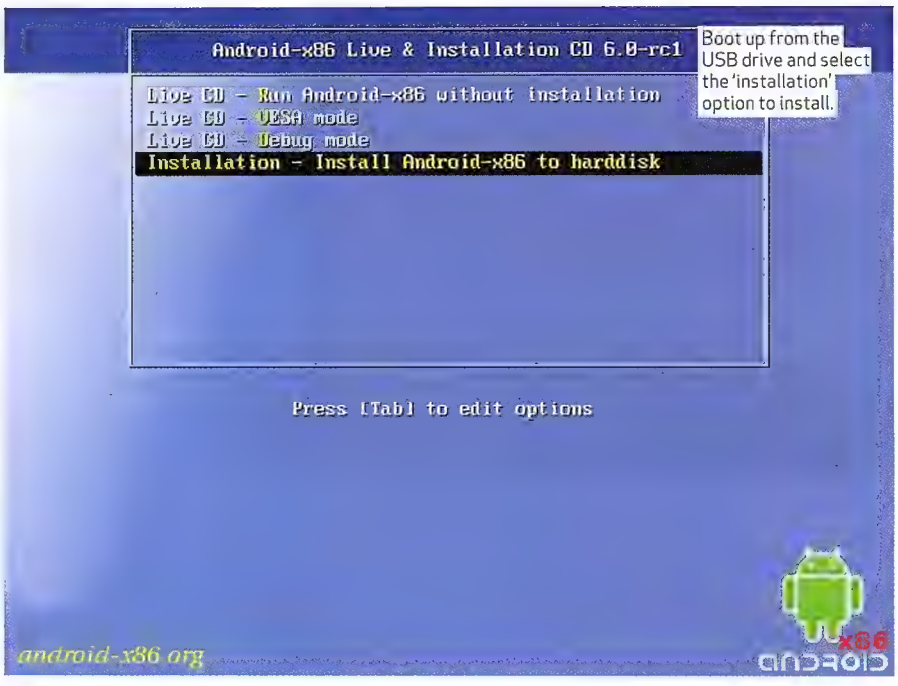
Since this is a first release candidate, you have to expect some things to need work and, all up, we'd grade this RC1 as 'passable' with some good and some not so good bits.

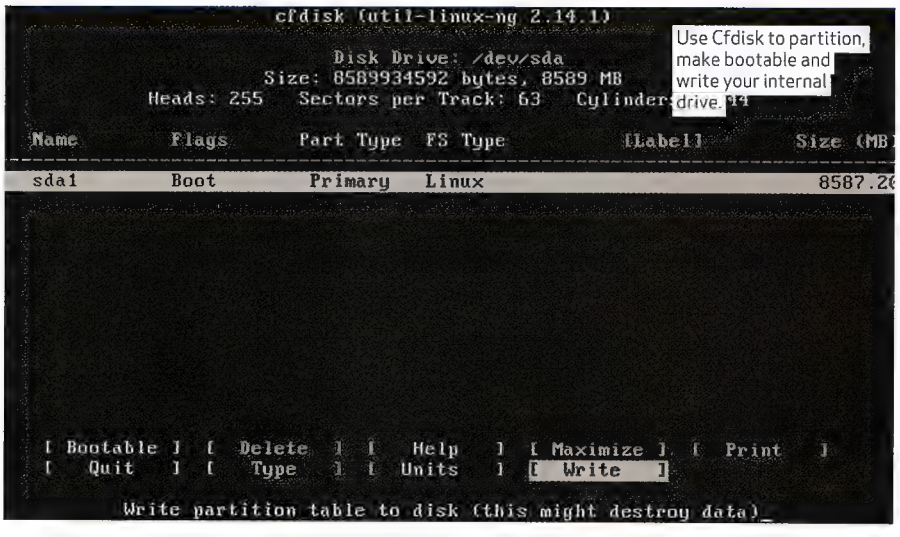
First off, one of the 'good bits' is that it comes with Google Play, Gmail and YouTube pre-built into the ISO image. This is nice because it gives you the basics you can build on with Google Play access, without having to hunt down an appropriate GApps pack to side-load first. We tested both Google Play and Gmail and they work a treat from the get-go.

Unfortunately, there are some things that didn't work, starting with the YouTube app. While it launches and displays the usual still-image catalogue of videos, try to play any of them and the app just bails. We tried setting the 'App Compatibility' option in Android's Settings menu to no avail. We also had the same problem with iView – the app launches, it'll even play a video for about a second and then bomb.

The more significant issue, however, that might be related is external USB storage seemed to be broken – we found USB flash drives mount, but to an odd 'MEDIA_RW' location. Most file managers we tried also can't see the drive and the few that do show no files. Our CQ42 test notebook also has an SD card reader, but again, Marshmallow recognises the card, but can't see any files.

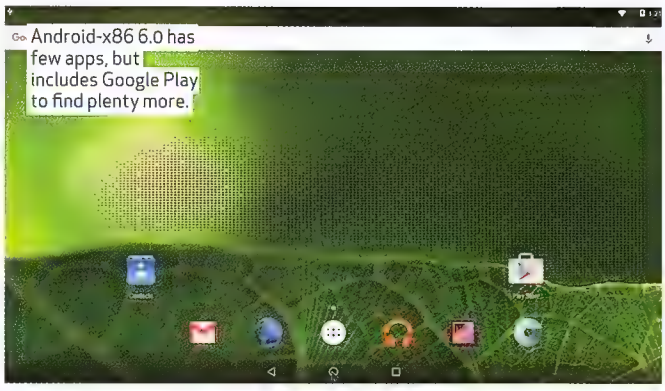
It's difficult to know exactly what's going on here – it may be just an issue affecting our setup, it may be more wide-spread. The only thing we can suggest is to give it a go yourself.

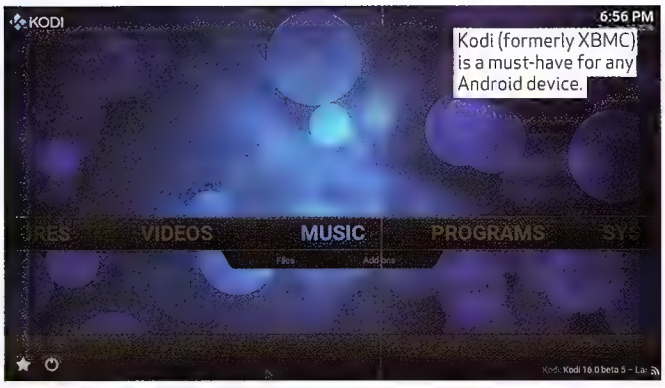

Android-x86 Live & Installation CD 6.0-rc1
Live CD - Run Android-x86 without installation
Live CD - VESA mode
Live CD - Debug mode
Installation - Install Android-x86 to harddisk
Press [Tab] to edit options
android-x86.org
Boot up from the USB drive and select the 'installation' option to install.

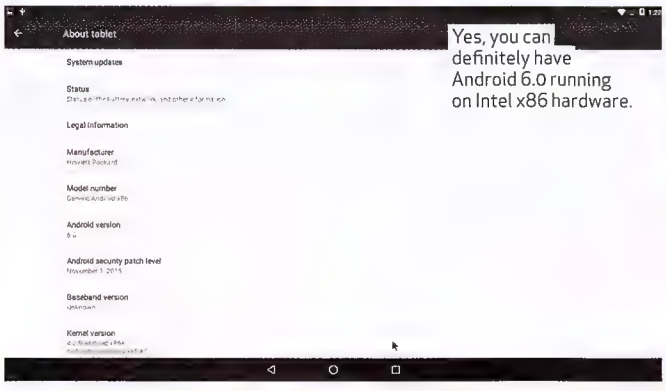

cfdisk (util-linux-ng 2.14.1)
Disk Drive: /dev/sda
Size: 8589934592 bytes, 8589 MB
Heads: 255 Sectors per Track: 63 Cylinders:
Name Flags Part Type FS Type [Label] Size (MB)
sda1 Boot Primary Linux
[Bootable] [Delete] [Help] [Maximize] [Print]
[Quit] [Type] [Units] [Write]
Write partition table to disk (this might destroy data)
Use Cfdisk to partition, make bootable and write your internal drive.

There's also no root access – and at the moment, there doesn't appear to be a working solution yet either, but we suspect that's more a problem with Marshmallow being so new.

However, the thing that surprised us the most is just how little x86 CPU performance you need to get some decent fun happening. The CQ42-135TU packs a 1.9GHz dual-core







"You have to expect some things to need work and, all up, we'd grade this RC1 as passable."

Celeron T3100 CPU and integrated Intel GPU, so it's nothing flash, yet it handles all the usual gaming suspects from *Clash of Clans* to *Beach Buggy Blitz* and *Angry Birds* with ease.

GAMING PERIPHERALS

Speaking of gaming, another surprise was built-in support for USB gamepads. We plugged in a basic Logitech GamePad F310 and had it instantly up and running on *Beach Buggy Racing* with all controls working as designed. We also tried a Spartan PS3 USB controller, but while steering worked, the accelerator triggers weren't mapped correctly and we went nowhere. Bottom-line, you may find it a bit hit and miss depending on the hardware you have on hand. As we said before, there's no real way of telling what will and won't work until you try it out.

STREAMING VIDEO

If you have your video library on a server somewhere in your home, you should be able to fire up Kodi (formerly XBMC) and stream content over your wireless network direct to your new Android PC. We tried using MX Player in conjunction ES File Explorer's network/SAMBA access but unfortunately, couldn't make it work. However, KODI, in combination with ES File Explorer, got the job done nicely.

On the other hand, chromecasting – streaming the system screen to your Chromecast dongle for display on your telly – didn't work in our case, but that is likely more to do with lack of casting support in the Wi-Fi hardware of the CQ42. On the up-side, USB audio works. We plugged in a Burr-Brown PCM2704C DAC connected via USB and had it playing the audio from a movie streamed with Kodi over our wireless network.

And just for fun, we also tried the CQ42's built-in Ethernet port – turning off Wi-Fi, Marshmallow auto-switched to Ethernet connection and continued on as normal.

OTHER OPTIONS

If Marshmallow RC1 isn't stable enough for your needs, you can always go back to Android 5.1.1/Lollipop or 4.4/KitKat and give them a try. Android-x86 has versions going back further than Jelly Bean, but given some of the security issues floating about, we recommend starting at KitKat. They're available as ISO images from the **Android-x86.org** download page, just follow the same installation method as shown above.

ROTATION LOCK

However, regardless of which version of Android-x86 you try, one tip we do recommend very early on is to install a rotation lock app. You'll find that some apps will anonymously, automatically and annoyingly swing the screen orientation around to portrait mode. You can imagine the fun trying to move a mouse cursor in one axis when your eyes and brain are trying to move it in another. Lock the screen in 'landscape' mode and you'll be right as rain.

STILL WORTH A GO

All up, our experience was mostly good, with just the external USB storage mounting giving us a bit of grief. But the great thing about Android is that it's a current-generation OS with a busload of software that doesn't require the latest hardware to make good. Android-x86 6.0 still needs work, but there is plenty of potential and we're hoping the Android-x86 team will release more RCs shortly that iron out these bugs.

In the meantime, it's still good enough to play games, watch your own streaming video, work on cloud documents, browse the web, do your email, listen to USB audio. Of course, your mileage will vary, but if the more traditional Linux distros don't do it for you, here's a way to keep your old hardware on the front line with an OS you're more likely familiar with.

Swamp Thing has really let himself go.

FROM US$59 VIA STEAM | PC | XCOM.COM

apc HOT PRODUCT

XCOM 2

The aliens strike back in the exceptional strategy sequel.

Deep inside your flying base is a bar dedicated to fallen soldiers. It has a list of each soldier's name, time of death and the operation they died in. It's a trigger for dark memories. Reading down, I remember one soldier crushed to death by a giant snake, another burnt to death in a ruined office. Another shot dead, then psychically resurrected to fight her friends. Operation Dismal Window was a bad day for rookie Neel Mehra. Sergeant Flynn Hudson bit the dust in Operation Half-Eaten Tears. If it wasn't obvious from *XCOM*'s ominous naming convention for operations, this is a tough gig. But these are the heroes you'll remember when the lasers stop. These are the fallen stars in this gruelling, outstanding strategy game.

Humanity seems doomed from the outset in *XCOM 2*. The game assumes you failed in your attempts to repel the alien invasion in *Enemy Unknown*. Now Earth's citizens live a coddled life under the totalitarian control of the aliens and their co-opted soldiery, Advent. The resistance lives on only in the form of a few determined soldiers, scientists and engineers who have managed to repurpose a huge alien ship, the Avenger. This is your home.

A detailed cross-section of the vessel lets you zoom into rooms to initiate research and building projects. A central cluster of rooms can be cleared out to build new facilities, and on the bridge you access the Geoscape, a map of the world that lets you choose where you want to park your spacecraft.

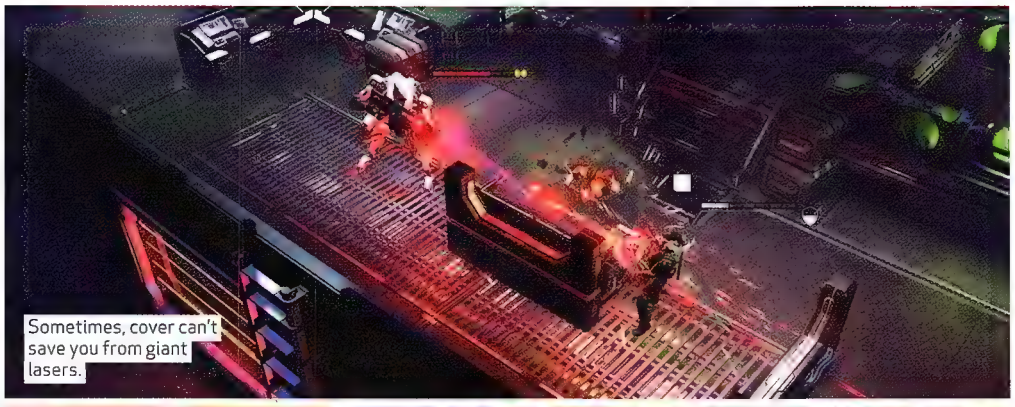
To fight back, you must expand your reach from your lone starting territory by contacting nearby resistance groups. Time is frozen on the Geoscape, but when you park over an objective – make resistance contact; acquire resources; contact the black market – you activate a timer and spend precious days to claim it. This is nerve-racking. At any moment your scans can be interrupted by an alien attack, or a mission that will let you attack the aliens. You can choose to ignore some of these, but it's not wise. Missions net you important resources, give your soldiers a chance to gain experience, and counter 'Dark Events' – varied alien initiatives that, among many options, can halve your income for a month, or send an interceptor out to hunt The Avenger. Just describing the strategic layer doesn't capture the rhythm of success and setback that makes it so gripping. The game cleverly uses scarcity of opportunity to force you into difficult dilemmas. At any one time, you might have only six possible scan sites, while combat encounters are largely meted out by the game, but what you choose to do with this narrow range of options matters enormously. You need to recruit new rookies; you need an engineer to build a comms facility that will let you contact more territories; you need alien alloys to upgrade your weapons. You can't have all of these. You can probably only have one.

In 1989, Sid Meier described games as "a series of interesting decisions". *XCOM 2* is the purest expression of that ethos that Firaxis has yet produced.

CLOSE ENCOUNTERS

The moment the timer freezes during a scan, I stop breathing. There's a notification screen you have to click through to find out what is about to try to kill you – I swear this is intentional, to let the sense of dread register for a second or two. If you're lucky, it's the council getting in touch to give you a thumbs-up and tell you they've dropped some sandwiches for you in South America. If you're unlucky, you'll be faced with *XCOM 2*'s equivalent of *Enemy Unknown*'s 'Terror' missions. Dubbed 'Retaliation', these once again ask you to rescue civilians from the battlefield while the aliens' best troops try to annihilate them. I have to steel myself for every fight, knowing that a bad performance could ruin my plans. Combat is turn-based and takes place on procedural battlefields that are uncannily well generated. For the vast majority of battles, the terrain is busy, interesting and benefits from a huge leap in visual fidelity from *Enemy Unknown*. The snowy forests, slums, city centres and alien bases are varied both in decorative assets, such as sleek futuristic cars and fluffy trees, and in the verticality provided by cliffs and multistorey buildings.

They blow up nicely, too. I'll commonly grenade a wall to remove cover and offer my



Sometimes, cover can't save you from giant lasers.

Berserkers exist only to smash

Stun baton guy can't believe this charge worked.

XCOM 2's sleek supercars can super-explode.

soldiers high-chance shots at a target. To my surprise, I also discovered that soldiers running around above ground level can fall through the floor if they're in a burning building. Explosions can start fires that propagate, blocking floor tiles. One of my grenades started a fire next to a terminal I had to hack. Sending a soldier to stand in that fire and hack the console was not one of my finest *XCOM* moments.

The four soldier classes have been revamped. *Enemy Unknown* players will recognise the suppressive heavy-weapon capabilities of the grenadier, and the sniping ability of the sharpshooter, but both can access new abilities that alter their jobs. The sharpshooter's gunslinger skills, earned by levelling up, can turn them into an effective mid-range pistolier who can take out multiple enemies in style, while the grenadier can improve the explosive potential of their grenade launcher, effectively merging *Enemy Unknown*'s heavy and support roles in one class.

The other two classes are less familiar. The specialist has a drone, which can move around the battlefield to heal allies, zap enemies or hack alien comms towers, and also has robots to disable or even temporarily steal units. The ranger fills the speedy, close-range role formerly occupied by the assault class, but they have a sword for high-risk, high-damage charge attacks, and therefore win. They can also pursue the scout skill track, which lets them strike very effectively from stealth.

HUNTING THE HUNTERS

Stealth is new. You start most battles incognito, and can freely move around the map without being attacked, as long as you stay out of the red detection range of enemies, lingering civilians and watchtowers. By putting most of your units in overwatch – the staple *XCOM* move that gives your soldiers free reaction shots against movement in the enemy turn – you can set up deeply satisfying ambushes. With my trap primed, I use my sharpshooter to break stealth and get a near-certain kill shot on the most dangerous enemy. As the alien mob scatters, their movement activates fire from the rest of my team. The camera swoops between them as they open up, shredding the enemy in glorious slow-motion.

Once concealment is broken, life becomes much more difficult. Successful shots are dictated by chance rolls, and you secure favourable odds by staying in good cover and flanking. A poor move or a stroke of bad luck can wipe out a soldier, or take them out of action for days. Time-limited objectives to hack a terminal or rescue/assassinate a VIP in a certain number of turns force you to be reckless. What's more, all alien variants, bar the lowest tier of enemy soldier, have the capacity to be incredibly disruptive. The lowly Sectoids of *Enemy Unknown* are all grown up, and can mind-control your troops and resurrect corpses.

I won't ruin the surprise and horror of the more advanced alien troops, but a couple left me in despair after a massacre, wondering if I had the soldiers and the ability to go on.

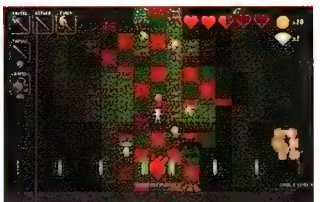
I can find little to criticise. The camera occasionally wafts through walls in close-ups, there's sometimes a lengthy pause before the character you're watching acts. A lack of foreknowledge in your first playthrough will hurt your ability to plan, too, forcing you to be more reactive, though the constant flow of new enemy types and story missions makes up for that. Thanks to your varying starting position, procedural missions and tactical depth, *XCOM 2* can and should be played repeatedly.

■ Tom Senior

Verdict

Exceptionally tough, rewarding strategy and a masterful reworking of the *XCOM* formula.

★★★★½



Crypt of the NecroDancer

Dance like nobody's living.

FROM US$14.99 | PC, PS4, X1
NECRODANCER.COM

Meaningful relationships are hard work. They require patience and commitment. And this rhythm-action, dungeon-crawling monster mash-up proves it's not true love until you're banging your head against the walls... to a hot 8-bit beat. The soundtrack is genius and integral to NecroDancer. You hop through levels by pounding keys in time to tasty throbs and riffs, an on-screen indicator helping you to multiply loot and light up the dancefloor. Undead enemies hilariously shimmy their hips and shoulders to the beat, too, meaning you must run the groovy gauntlet in a precise pattern to breach skeletons' shields or avoid dragons' flame attacks. If that wasn't enough to mill your teeth into a fine dust, beating mini-bosses means a new level unlocks, where the music changes and the beats per minute increase, sending real and on-screen hearts racing. You'll need handouts: NecroDancer's four zones are unrelenting, and take hours of complex cha-cha-sliding to clear. Its roguelike randomisation can produce unfair boss-rush situations, and endless restarts aren't instantaneous like fellow self-esteem-ruiner *Super Meat Boy*. I love it unconditionally. For every argument, we have a moment of telepathic understanding in which we're dancing cheek-to-cheek, razing dungeons in a sublime strategic pulse. Rhythm and roguelike make a perfect pairing: complex and undoubtedly frustrating, but always a joy.

■ Jen Simpkins

US$39.99 | PC, PS4 | THE-WITNESS.NET

The Witness

Get ready to draw the line.

We really hope you like maze puzzles. Because that is, for the largest part, what *The Witness* is. A seemingly endless collection of mazes on little screens: draw a line from start to finish and you're done.

Except you're not, really, because often the mazes appear in clusters and groups anywhere up to eight at a time, and nearly always reward you with more mazes. Mazes, mazes, mazes. If you feel like the word is starting to lose all meaning already, try playing a game where it's all you do for hours at a time.

Now, you might think this is an exaggeration, that there must be something else. While the forms may change in unexpected ways, solving mazes is most definitely the task at hand. Style, rules and other twists add variety – you might have to separate dots or pair colours with the lines you draw, or look to the environment for clues – but ultimately the end result is the same: draw a little line and repeat the process.

Here's an example: early on in the game, you find a door that can be opened by, you guessed it, a maze puzzle. But the puzzle itself is locked. Opening it requires you to solve a bank of five mazes. They, in turn, activate a set of six more and, when they've been solved, those switch on another seven. Only then, when you've solved all 18... can you solve the one locking the door.

You emerge into this setting via a tunnel, with no fanfare, welcome or support. From there, it's up to you to make your own way through the world, piecing together what you can and solving maze after maze after maze. Uncompromising, it gives you nothing in the way of aid or encouragement. The tutorial consists of little more than teaching you how to interact with the puzzles and telling you there's a run button. After that, you wander the island, interacting with themed mazes and trying to piece together increasingly complex solutions.

The variations are plentiful, but it's still mazes, and there's a huge amount of mental fatigue to repeating the same thing over and over again.

The game doesn't try to help you much either. There's a needlessly nasty mechanic where, for some sequences, making a mistake deactivates the current maze, meaning you have to reactivate it by redoing the previous panel. Sometimes, it also seems to pile on the rules, too, or twist them as soon as you've got a handle on what they want from you. There's usually a code of sorts that helps you work out specific requirements – group these, split those, draw over that... In some cases, multiple rules are applied as you progress, with modifiers and alterations as you go. What momentum you build and the fun you get from finding solutions and solving puzzles can be stopped dead by this sort of thing.

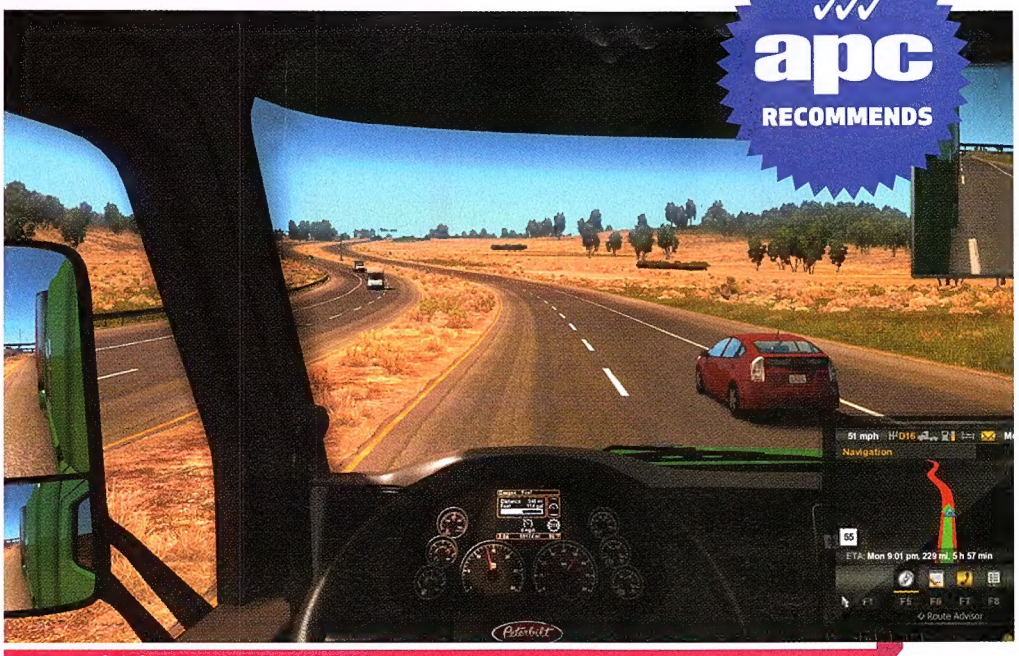
It makes *The Witness* a very odd experience. It's capable of making you feel amazing when you 'get' something, but it's also callous in its indifference. Stuck? Uncertain or unsure? Tough. This game has no time for the weak. You won't get any help. Some will relish the challenge and there's something to be said for the achievements to be had. However, if the idea of *Dark Souls: Maze Edition* doesn't appeal, then approach with utmost caution.

■ Leon Hurley

Verdict

Sometimes rewarding but highly repetitive, this puzzle game drives its core idea into the ground.

★★★½☆



US$19.99 | PC | WORLDOFTRUCKS.COM

American Truck Simulator

Our favourite route-'em-up crosses the pond.

I'm driving down a long, remote desert road in the dead of night. There's no other traffic and I can't see anything except the glow of my headlights and the cracked, dusty asphalt ahead. I'm hypnotised by the road, which seems to go on forever. My attention drifts. 'In the Air Tonight' by Phil Collins plays on the classic rock radio station I'm tuned to. Then, suddenly, something appears directly in front of me. A shape on the road.

I panic, my heart racing. In a long instant I think: is it a car? An animal? I slam on the brakes and skid to a lurching halt. Then I see it: a tumbleweed rolling lazily across the road in front of me, lit up by the glow of my lights. I laugh at myself and continue towards Los Angeles. I've got 30 tonnes of fertiliser to deliver and time's running out. This is what passes for an anecdote in *American Truck Simulator*, a game so slow and uneventful that the sudden appearance of tumbleweed is genuinely thrilling. These little moments feel almost like rewards. A brief glimmer of excitement in a long drive across vast swathes of largely empty nothingness.

Like its predecessor, *Euro Truck Simulator 2*, it's a game that is mysteriously compelling despite its mundane subject matter. It's a fundamentally good game, with weighty, nuanced handling, a deep simulation and higher production values than most sims. This results in something both very playable and oddly hypnotic. Driving from place to place, obeying the traffic laws, watching the scenery roll by, listening to the radio... it's incredibly relaxing.

There are two main ways to play. One is working as a freelance gun for hire, taking on delivery jobs where your truck and fuel expenses are provided by your employer. This is the easiest, most accessible way to play, and as you level up, you can spend XP to unlock more lucrative jobs including longer hauls and fragile or dangerous cargo. These earn you money that can be spent unlocking the other side of the game: running your own business. Once you earn enough money to buy your own truck – or take out a bank loan if you're impatient – you can start your own company. You choose which city you're based in and can customise and upgrade your truck. Eventually, you hire drivers and create your very own haulage network. It's a fairly involved business management sim, but entirely optional.

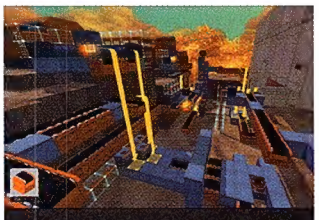
At launch, *American Truck Simulator* comes with two states: California and Nevada. More will be added over time, but it is slightly disappointing that you can't yet drive from coast to coast. Still, it's a huge space, and you can visit cities including San Francisco, Los Angeles, San Diego and Las Vegas – and a number of small towns between. Anyone who played *Euro Truck Simulator 2* may find the game a little too familiar in places. As a result, if you were already burned out on *ETS2*, the new setting might not be enough to reignite your passion. It's a very similar experience overall.

■ Andy Kelly

Verdict

A great start, but *American Truck Simulator* will really begin to take shape when more states are added.

★★★★☆



Infinifactory

A chip off the old block.

US$24.99 | PC, PS4
ZACHTRONICS.COM

Hitting Level 99, landing a perfect combo, organising your inventory — all are satisfying achievements. However, believe me when I say they don't quite compare with crafting a colossal assembly line out of nothing but virtual building blocks. A playpen puzzler with a space-age heart, *Infiniminer*'s spiritual successor goes back to the block genre's square roots. Held captive by aliens, you must use your knowledge of the third dimension to create machines that can mass-produce space knick-knacks and, er, meat treats — you're also obliged to eat your food pellets like a good human. Initially, as in *Oddworld*'s *RuptureFarms*, you feel you might be treading the darkly comic line between employee and new 'n' tasty snack, but that streak of black comedy soon dwindles into a rasher-thin backdrop for demanding puzzles. *Infinifactory*'s gameplay mirrors *Minecraft* in Creative mode, but with the addition of purpose. You're given a jetpack, an assortment of blocks and a holographic blueprint of the product required — how you put that product together, of course, is left to your imagination. It's like assembling a bookshelf without the instructions — sure you might have a few screws left over, but the warm, fuzzy glow of knowing you did it your way will linger long after it collapses.

■ Jenny Baker

GAME ON, BARBIE!

Mattel comes out from under its rock.

In the last week of January, Mattel revealed its new line of Barbie dolls, which not only included three new sizes (tall, curvy and petite), but which also included practical-shoe-wearing spies, a president and a game developer. With long red hair, headphones, jeans and a laptop, Game Developer Barbie is by far the coolest-looking of the new dolls. This reflects Mattel's slogan that tells young girls "you can be anything". We can only hope to see Game Developer Barbie get some useful accessories, like an ergonomic chair or a more powerful PC... Just an idea, Mattel.

The eagle has landed... on a drone

BIRDS OF PREY TO ENFORCE NO-FLY ZONES.

With the rise of consumer aerial drones across the world, so too increases the problem of enforcing no-fly zones. Ground-based anti-aircraft options are peppered with potential problems, strangely enough. Dutch police are, therefore, considering using eagles to snatch the drones out of the sky. The police posted a video to its official YouTube channel, featuring two of its new winged allies successfully (and easily) capturing a lightweight but fairly sizable quadcopter and delivering it back to the ground. While the Dutch police have said that the birds' safety is a matter they are taking seriously, it still raises the question how these powerful eagles will cope against a more heavy-duty drone.

You can now run Windows 95 in your browser

WHERE DO YOU WANT TO GO TODAY?

"Back to 1995!" is what Andrea Faulds must have replied. This 19-year-old developer from Scotland has managed to get Windows 95 to run completely functionally in your browser (**https://win95.ajf.me**). It runs entirely on JavaScript, allowing you the nostalgic glee of being able to mess around in Windows 95 without having to install anything. It's like going to a museum, but for software, where you can actually touch the exhibits without security coming down on you like a tonne of bricks. However, beyond the educational side, there is very little 'point' to this feat except "because it's fun, duh". If you're in the mood for a little nostalgia, why not give it a go?

Former British Prime Minister's card game hits the App Store

YOU WILL DEFINITELY NEED PATIENCE. LOTS OF IT.

"I have nothing to offer but blood, toil, tears and sweat"... and solitaire! According to Donald Rumsfeld (former US Secretary of Defense), he was taught the card game by a Belgian ambassador, who in turn learnt it from his friend Winston Churchill (former British Prime Minister). It's similar to normal solitaire, but with two decks of cards laid out in ten rows and a sort of campaign that sees you promoted from Sandhurst Cadet through to Field Marshal and, eventually, Prime Minister. The difficulty level increases as you continue to play, meaning the odds are always against you, but you must never surrender — just like war, eh, Winston? ■

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PC Case Gear	03 9551 0889	pccasegear.com
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PC Solutions 4 U	08 89412119	pcsolutions4u.com.au
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